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The Welding Engineer

DECEMBER, 1944

THE PIONEER TECHNICAL PUBLICATION OF THE WELDING INDUSTRY

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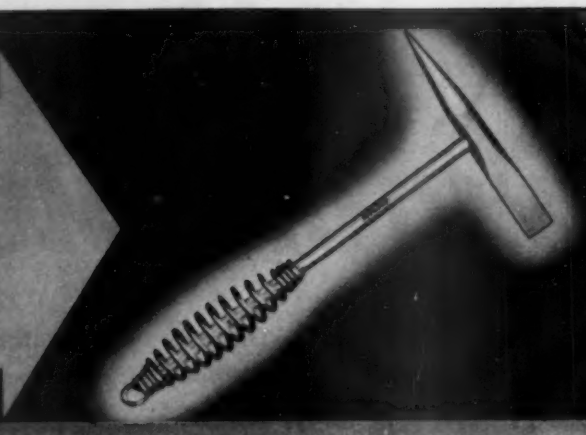
TOOL OF THE MONTH



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The Welding Engineer

AMERICA'S PIONEER WELDING JOURNAL

Established 1916

The Roadblock of Ignorance

Several weeks ago I received a telephone call requesting information. The inquirer wanted to know: "What is the meaning of a welding symbol which consists of an arrow and a line with a saw-tooth symbol under the line? Also, what's an arrow and line with slanting parallel lines under and at about 60 deg with the line?"

The answer was not too difficult, though I had to dig deep into my memory. Someone was anxious to use welding, but they were indicating fillet welds on their drawings by symbols which first came into use 15 years ago—and went out of use nearly ten years ago.

Are those who made those drawings ten years behind time in welding? Or are they up-to-date on the advances in welding and ten years behind *only* in their use of welding symbols? The answers to these questions are of vital interest to all of us in the welding industry.

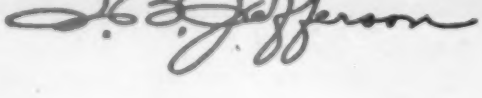
It is indeed a tragedy if a fabricator thoroughly familiar with present welding applications and possibilities is wholly ignorant of present-day welding symbols. And it calls for action.

Through its welding symbols the American Welding Society has developed a universal sign language of welding. These symbols have been adopted as American Standards by the American Standards Association. Apparently, however, the job is only half done. It is now up to all of us who make up the welding industry to see that these symbols are used. And used correctly.

Dr. Samuel Johnson, author of the first English dictionary, was queried by a certain lady as to why he had defined a word as he did. He replied: "Ignorance, Madam, ignorance." It is a poor excuse. We cannot afford to allow ignorance on the part of those who should use welding to impede our postwar progress. Every individual, every agency, private or Governmental, every Governmental regulatory body must be educated in the use of proper welding symbols and proper welding terms. They must likewise be apprised of the authenticity of the American Welding Society codes and specifications.

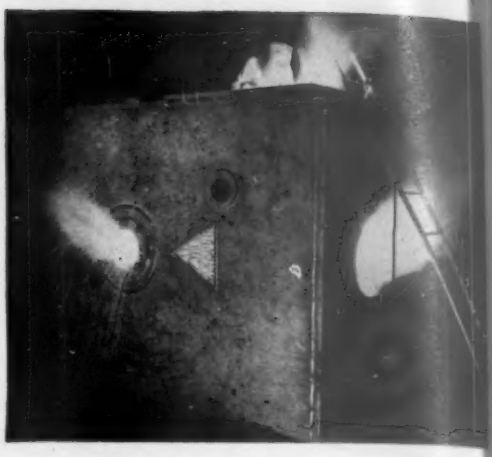
It will not be enough to teach engineers the advantages of welding. We must go on down the line. Every draftsman, detailer or individual who has anything to do with the preparation of drawings for fabrication must be fully conversant with welding's advantages and possibilities. Otherwise, the smaller parts which are often left to the ingenuity of a detailer may be left to one who is not familiar with the use of welding. So that welding will be used to its fullest extent, it is important for us to see that knowledge is dispensed all along the line.

The war has given impetus to welding. Our greatest opportunities lie ahead. Before we can fully grasp these opportunities, however, we of the welding industry must proceed to educate all possible users of welding in every way possible. The roadblock of ignorance must be broken, once and for all.



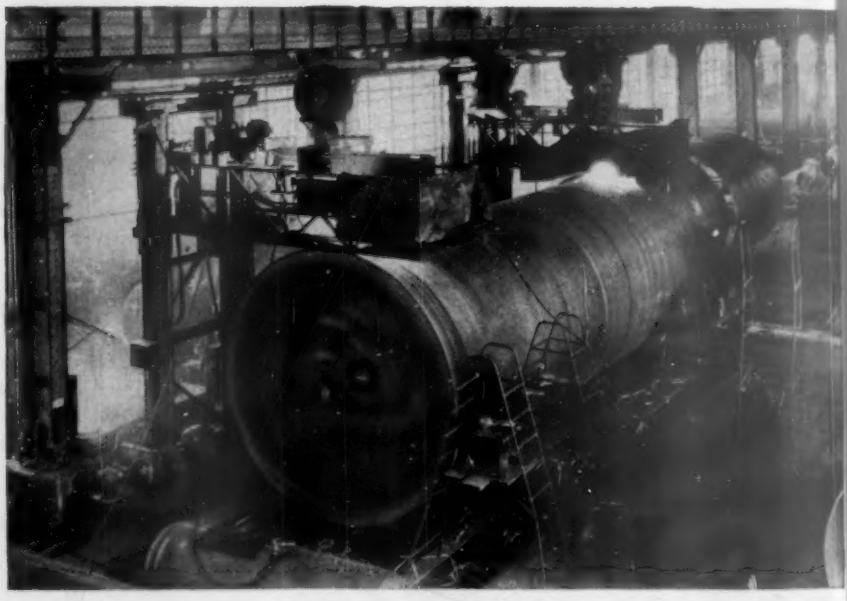
AUTOMATIC WELDING has many advantages in fabricating boiler drums, cracking stills and other products for which repetitive welding is practical. Deposit rate is often greater because of the use of higher currents, and a larger ratio of welding time to working time, compared with manual welding. The strength and high quality of the weld are due to the close control of the arc and the excellent fusion possible at high currents using Murex Electrodes.

Murex rods available for automatic welding are Type F, Carbon Moly. 50 and Cromansil. The spiral asbestos winding of these rods anchors the coating to the core wire so that the electrodes may be coiled without cracking and also provides an absolutely concentric coating that does not spawl off under the slitter.



THIS STRIKING action photograph illustrates the use of Murex Electrodes in welding the top member of a single action, single eccentric press, fabricated by Clearing Machine Corporation. Press frames are positioned with only four turns. The sides weigh from 80,000 to 90,000 lbs. and some plates are 10″ thick. Double-Vee welds, back-stepped, are employed.

HUGE PRESSURE VESSELS over 6′ in diameter, up to 35′ long and having a shell thickness of 4″ to 5″ are welded automatically by Foster Wheeler Corporation with Murex Type F and Carbon Moly. 50 electrodes in continuous coils. The soundness of the weld metal is shown by the fact that as many as 44 longitudinal boiler drum seams have been welded consecutively, with only five minor defects showing up under X-ray examination.



CRANE GIRDERS are subject to severe overloads and the shock of sudden stops and quick reversals. Manning, Maxwell & Moore, Inc., applying a special technique, uses Murex Electrodes in the construction of its "Shaweld" crane girders. They are much stiffer laterally than riveted girders and more resistant to the twisting motion set up by the driving machinery. Positioning cradles are used to permit downhand welding on the girders which are exceptionally long and heavy.

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★ PRODUCTION

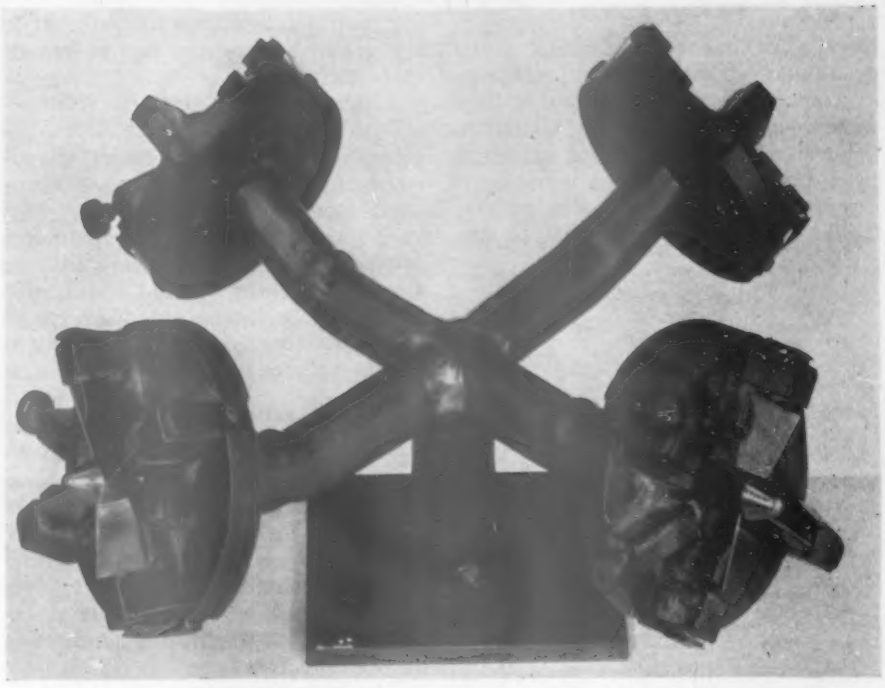


Fig. 1—Four brazing jigs located in a positioner. While one fixture is being loaded, another vane assembly is being brazed.

Production-Line Brazing

Gas brazing was found superior to arc welding for the fabrication of a certain propellerlike assembly used in a nose fuse. So operators who had been trained to arc weld were taught the use of torches instead. Many clever ideas made assembly-line production possible.

By **J. V. KIELB**

Staff Engineer for the Works Manager, Easy Washing Machine Corp.

IT ALL started eighteen months ago when the prime contractor received the job of manufacturing a nose fuse of new design. The unit consisted of many machined parts; processing and tooling did not present any difficulties except for one part called the vane assembly, which required the welding of four small blades to a hub. The production of this propellerlike assembly was uncertain because of the large quantities per month required under the contract. The new assembly, being small, required precision handling and welding.

Layout for Arc Welding

Specification and tool engineers completed a temporary layout calling for arc welding. Many preliminary investigations revealed the following data:

A-c or d-c machines could be used.

Maximum production: ten to fifteen welded assemblies per hour.

Number of weldors required for maximum production: 45 to 60.

Number of assemblers for maximum production: 45 to 60.

Number of jigs for maximum production: 40 to 50.

Welding assemblies must be shot-blasted in order to remove welding slag.

A training program for the personnel would be needed.

It will be immediately noticed a training program was required in order to qualify operators for welding this assembly. The present weldors in this plant on other contracts could not be taken from their jobs. The time limit for starting production was growing short, and something had to be done because the machining operations on material parts for this unit had already been started.

Immediately a separate organization was set up to handle this vane assembly within the welding department. To obtain experienced welding foremen and supervisors was the first step. After some study and investigation, a group of men who had been in the welding field for many years and had had a variety of experience in welding and supervision was selected. These key men had known one another for some time, preventing misunderstandings from arising among them. Furthermore, each man knew what was expected of him.

With the key men of the organization picked, work was next started on the training program. It was found that this welding job would require female welding operators and assemblers. Through the coöperation of the personnel department in carefully interviewing and studying individuals, a group of selected women was procured, less than 1% of whom failed to qualify as trainees. Throughout the entire contract, the labor turnover in this organization was less than 15%. Only 3% failed to prove ability in production; the remaining 12% left because of such reasons as husbands being transferred in Army location, ill health and pregnancy. This low turnover was due largely to the good understanding and coöperation prevailing among foremen, supervisors, welding operators and assemblers.

The lack of welding equipment within the plant necessitated a training program from outside sources. All of the welding schools in the locality were accordingly contacted, and arrangements were made to train the operators under the guidance of

a program for the particular assignment. The trainees were first given preliminary training in arc welding; as soon as they could qualify, they were assigned to weld a unit similar to the one that would be used in actual production. The trainees were coming along fine when all of a sudden they had to be changed over to gas

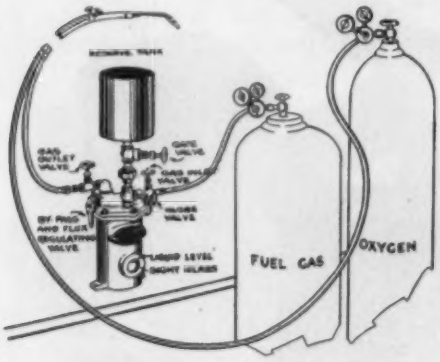


Fig. 2—Hook-up of the vapor flux dispenser to the acetylene cylinder.

welding in order that they might develop the brazing technique. This sudden change was due to the investigation work that had been going on in the experimental and testing end of this assembly.

Reasons for Brazing

The foremen who had been put in charge of this job proved that a better method of fabricating this vane assembly could be accomplished by the brazing procedure. The welding organization was not satisfied with the appearance of the vane assembly fabricated by arc welding. The fillet welds appeared bulky and crude at the start of the bead and crater, although the welds were actually of the best that arc welding could do to give the required strength for bend and impact tests. The brazing method gave similar strength for the bend and impact tests as well as excellent appearance. A sample specimen was approved and accepted by the Navy. Some thought was given to producing the assembly by the die-casting method, but this was found to be unsatisfactory and not acceptable to the Navy.

After preliminary gas-welding training of the first group of operators had been completed, they were returned to the plant for final instructions. Before starting any work, the operators were taken through the plant by the foreman in order to familiarize them with the unit they were to weld and the important part it played in the manufacture of the nose fuse. Once acquainted with the plant organization, they were given a short lecture by the foreman concerning their job and then turned over to the group leaders and instructors of their shifts.

Later on, welding trainees were developed from the experienced assemblers, who had gained much knowledge of the operation through constant loading and unloading of the vane assemblies. The assemblers proved to be good weldors within an amazingly short period, and this method of seeking welding operators was, therefore, maintained throughout the balance of the contract.

Starting to Work

The group leader and the instructor-supervisor worked hand-in-hand on the production line. These persons were former welding operators who had received job and method training instruction. These individuals took care of everything but disciplinary action, which was handled by the welding foreman.

The new operators started their work by learning to assemble their own units in order to familiarize them with assembly work in case a time would come when assemblers were short during a shift. The group leader would take every new operator along the production line and explain the fine techniques required at each stage before starting her on the job. The group leader also taught the new operators how to handle their equipment properly and abide by the safety rules and gave them needed information pertaining to the location of materials, welding wire, fluxes, safety equipment, lockers, etc. After a trainee had been given her station on the vane-assembly production line, the welding instructor demonstrated to her the function of each operation in detail.

Duties of Group Leaders

The group leaders were in charge of a group of twelve to fifteen operators. They had the following duties:

1. To open and close gas cylinders and make the necessary changes.
2. To set up the equipment for operators.
3. To see that no operators had to wait for their materials.
4. To control straightening operations.
5. To keep records of daily production.
6. To report any injury to First Aid.
7. To check material parts both before and after brazing for oil, grease, rust, burrs and fit-up.
8. To check with stock chasers on the flow of material before and after brazing.
9. To report anyone not qualified to the welding foreman.
10. To recommend suggestions to the welding foreman on any new methods of increasing production.
11. To see that weldors and assemblers were satisfied with their work.
12. To report to the foreman any other information that would help keep harmony.

Duties of Instructor-Supervisors

The welding instructor-supervisors had the following duties to perform:

1. To instruct all new welding operators or assemblers.
2. To check the daily production of both classes of operators for assembly and proper welding techniques.
3. To check all welding wire.
4. To stop any operator whose work was not satisfactory during the day.
5. To check torch tips daily to see that they were in the proper condition for brazing.
6. To work hand-in-hand with the inspection department on daily difficulties.
7. To explain the brazing procedure and technique on the vane assemblings.
8. To control the salvaging of units that had failed to pass inspection.

Jig Design

The jig for the vane assembly was redesigned after the pilot test run. The fit-up tolerance of the jig parts had been too fine because the tool engineers had failed to take heat absorption into the jig into consideration. The welding department designed a jig that would compensate for heat absorption. The cost of the new jig was reduced to $40 in comparison to the original design cost of approximately $325. To maintain maximum production, it was found, 48 jigs would have to be built. These jigs were checked regularly for alignment, and once a week a new spring-steel plate was placed on the alignment pin of the blade to insure sufficient pressure to hold the blades in location.

The welding table for this assembly consisted of six sections. The weldors were located along one side, directly opposite to the assemblers. The table was approximately 2 ft wide, 30 ft long and 3 ft high. A ¼ in. steel plate covered the working surface. In the center of each section a positioner was located for use in positioning the form jigs. Fig. 1 shows how four welding jigs were located in the positioner.

Gas Saver and Flame Control

Each section had a gas-saving unit, which aided in maintaining a uniform flame. Much time was saved in adjusting the flame control, which was set up by the welding instructor-supervisor. The correct flame was slightly carburizing. Particular care had to be taken to avoid use of an oxidizing flame, a practice which seemed to be common among new operators.

A ventilation system with flexible manifold and a small 12 by 12 in. hood was installed above each section approximately 12 in. above the positioner. Irritating fumes were set up by the flux, which had a calcium fluoride base. The suction was sufficient to draw away the fumes but not great

enough to create any draft upon the operators or affect the welding operations.

A small shield was placed on the hood, directly in front of the assembler, to avoid any glare from the flame. Later the assemblers wore tinted glasses to prevent eyestrain. A tube of pictrate salve was placed in each section for burns from the flame or from the touching of hot jigs. This proved to be very handy and prevented much blistering.

Automatic Fluxing

A unit for dispensing vapor flux was hooked directly to the acetylene line as shown in Fig. 2. This application was used with certain types of welding wire and eliminated hand fluxing of the vane assembly. The automatic flux performed the two duties of preventing oxidation of the vane assembly and aiding the flow of filler metal. It produced a highly greenish flame that was rather hard to control.

Each welding operator and assembler was at all times seated on a chair of the proper height, a convenience which contributed greatly to the maintenance of high production. It was found that an 8 hr day was sufficient for any operator, though in some cases operators had to work extra hours. The group leaders and instructors worked nine hours per day; the additional hour gave them half an hour before and after each shift in order to line up the necessary equipment and materials and to discuss their difficulties or relate any important matter which pertained to production.

The Job to Be Done

As illustrated in Fig. 3, the vane assembly consisted of four blades and a hub. SAE 1010 steel sheet was used for the blades while the hub was made from bar stock of a low-carbon, low-manganese steel. The original blades were blanked out and formed with a curved profile as illustrated on the lefthand side of Fig. 4. Later testing of the unit eliminated the curve and this forming operation.

When the stock chasers brought the blades and hubs, the parts were immediately checked by the group leaders for fit-up, grease, oil, rust and burrs. Sufficient parts for daily shift production were then dipped into carbon tetrachloride to remove any grease or oil developed through machining and handling. The assemblers avoided touching the parts with their bare hands in order to prevent the formation of moisture.

The assembler's duty was to place a hub on the center pin of the jig and then insert the four blades in the perpendicular blocks which held them to the hub (see Fig. 1). The edges of the blades were covered with a flux paste before they were put into the jig. A special jig was made to hold a large group of these blades so that they could be fluxed with a brush uniformly.

While the assemblers loaded one fixture, the weldors on the opposite side of the table were brazing another vane assembly. Of the four jigs placed on a positioner, two were parallel to the weldors and two were directly in line with them. As the positioner turned clockwise, the two jigs that were parallel to the operators contained one completely welded assembly and one unwelded one. The jig with the welded vane assembly was in a position where it would cool off before the assemblers removed it. As previously mentioned, the constant brazing caused a considerable amount of heat to accumulate in the jigs, which therefore acted as preheating units for the unwelded assemblies. The preheating temperature attained from the jig ranged between 300 and 400 F.

The jig with the vane assembly faced the welding operator so that two blades were at 45 deg angles to the perpendicular line, as illustrated in Fig. 3. The other two blades were in the same location but were in an upside-down position. The location of the blades in this position facilitated downhand welding.

The brazing of these vane assemblies required a special technique in order to maintain high production. The technique was to apply the flame to the hub at the start and to avoid heating the blades, which were only 1/16 in. thick. The distance between the hub and the edge of the torch tip was held very short in order to place maximum heat in the hub, which had a wall thickness of ¼ in.

Ordinary aircraft-type torches with tips of maximum orifice were used on this job. The brazing flame was slightly carburizing, as previously mentioned. A silver-brazing alloy was used for the majority of vane assemblies produced, but for poor set-ups a low-temperature-welding alloy was employed. Use of the latter usually resulted in a small fillet on both sides of the blade, adding to the strength of the joint. Most failures in the welded area were caused by poor set-ups.

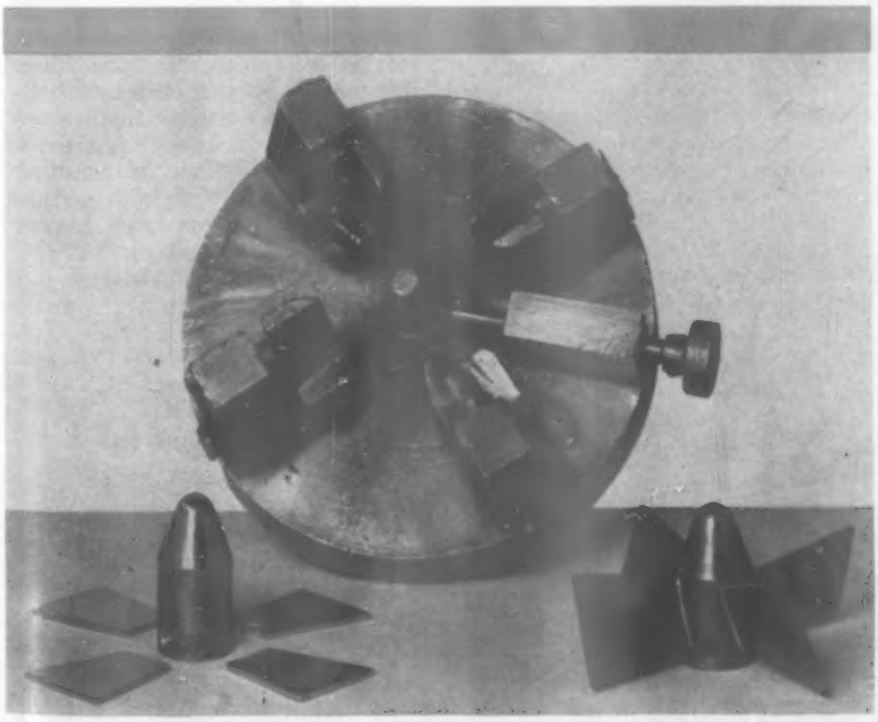


Fig. 3—Vane assembly before and after brazing. The type of brazing done is clearly indicated on the right. The jig for this assembly is shown in the center.

Brazing Procedure

The assembly was first brought to the proper brazing temperature, between 1,200 and 1,300 F, which was indicated by the liquefaction of the flux. The brazing wire was applied to the down side of one blade and then to the other blade, resulting in small filler deposits along the length of the blade adjacent to the hub. To insure complete capillary action the operator would immediately reverse the torch to the opposite side of each blade and sweat the alloy filler to that side. This minimized the original filler deposit.

Two tip torches were used by some

operators in order to maintain high production. Generally, no fillets existed on either side of the blades because the maximum strength of the joint was attained by maintaining a good fit-up of 0.0015 to 0.003 in. The illustration of the welding vane assembly in Fig. 3 clearly shows the type of brazing employed.

After welding the two upright blades, the operator flipped the jig with her hands or with the backside of the tip so that the lower blades came into the same position as the previous two blades. The second two blades required no preheating, and the torch was immediately positioned into the corner of the blade and hub. The brazing of these blades was done much faster in order to avoid overheating and prevent oxidizing and scaling of the upper section of each blade. The torch distance after preheating was increased from ¼ to 1½ in. away from the weld zone. Proper sloping of the torch was also important. By developing good wrist action, the operator could manipulate her torch so that the proper heat was applied to the hub and blade simultaneously. After finishing the last pair of blades, the operator would make a quick check to see that all areas were covered with filler metal. The positioner was then turned to the next vane assembly.

Unloading Assemblies

The brazed vane assemblies were removed by the assembler and placed in a small box marked with the operator's name and number. If the assembler noticed poor brazing or a mislocation of the vane on the hub, she would allow that particular assembly to remain on the jig and be returned to the welding operator.

The two extra jigs were located on the table and were loaded by the assembler in order to keep up with the welding operation. This type of production went on for 7½ hours per shift. The average welding operator's time for welding the four blades to the hub was less than a minute, averaging 60 to 70 vane assemblies per hour or 450 to 500 per day. A few operators were able to turn out 90 to 100 units in an hour.

The assembler, in many instances, had a tough time keeping up with the welding operator on trial runs for higher production. In this set-up it would take three assemblers to load for two weldors. However, this practice was employed only in emergency production orders. Usually, it was found that the brazing department was giving greater production than the machine operations, which sometimes caused delay in the brazing production of the vane assembly. The average time for an assembler for the assembly of the unit in the jig was 30 seconds or for a total time including loading and unloading 45 to 50 seconds.

After seeing production results like this, one wonders if the rejects and scrap assemblies were above normal number. The answer is "No." The department maintained daily production charts for all shifts per day, per week and per month. In addition, a quality control chart governing the welding operators and the assemblers on weekly production totals was also maintained. The items of reject were listed as scrapped, high blades, low blades, excessive filler metal, cracked, broken and unwelded blades. If any workers were running high in one of the items daily, they were told to check for corrections. In most cases the repair was done by the particular worker who had caused the reject.

Under this method of welding, consisting of proper fixtures, jigs and good material, parts control, welding accessories, proper set-up, good supervision, proper training and good production control of the operators and assemblers, the maximum production was easy to maintain. It was also found that the number of welding operators necessary for the job was reduced by 50% and that only two shifts were necessary. Furthermore, Sunday work was completely eliminated.

Inspection

A group inspection-supervisor was held responsible for 100% inspection of the brazed assembly. The welding department conducted many tests in order to show the strength of the filler metal and what would happen to the blades if loads were applied on the blades against the hub. Fig. 4 illustrates three sample specimens. The first sample on the left side shows the original contours of the blades and their proper location on the hub; this was a finished assembly. The second sample illustrates application of the load to the bottom side of the blades in an upward direction while the hub remained stationary; the results show that the filler metal held the blade to the hub, and the shearing of the blades started outside the welded area. This method of loading was reversed, and the test again proved that the filler metal was stronger than the base metal of the blade.

The third sample (right) illustrates the results when loads were applied to each blade. Even the complete bending of the blade caused no breakage in the filler metal. The continual working of the load in both directions in the same plane would result in the breakage of the blades at a point outside the filler metal. Such tests as these were conducted periodically.

A straight-line production inspection was set up for the inspection of the unit before plating. The welded vane assembly, washed and freed of flux and scale, was first inspected for proper location of the blades to the hub in respect to the tapped holes; the profile of the blades was also checked. After another inspection of the drilled and tapped holes, the assembly was placed on an actual test unit to check it for high and low blades. The most important to watch for was the low blade as this would prevent the collar of the unit from locking.

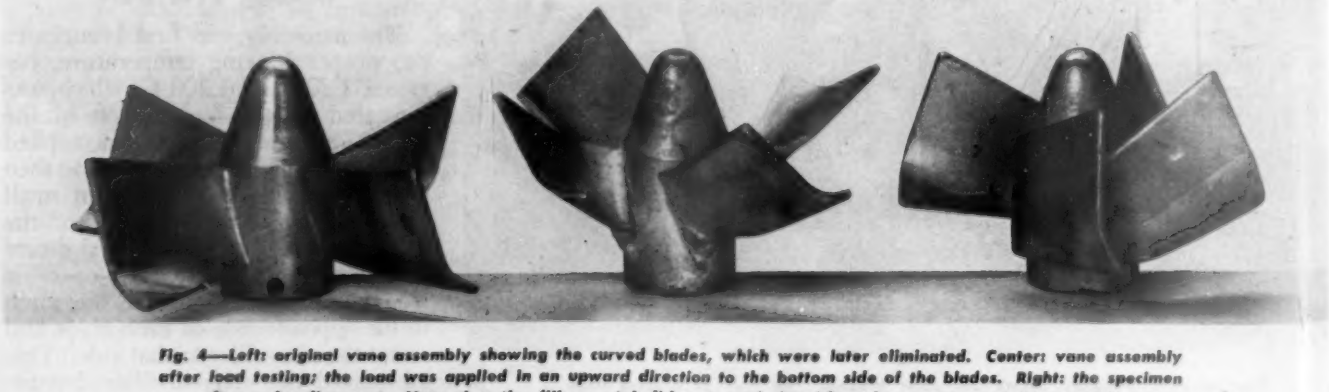


Fig. 4—Left: original vane assembly showing the curved blades, which were later eliminated. Center: vane assembly after load testing; the load was applied in an upward direction to the bottom side of the blades. Right: the specimen after a bending test. Note that the filler metal did not crack in either the center or right assemblies.

★ RESEARCH

Cold-Weather Welding

Shipyard welding used to stop when the thermometer fell to below 10 F. Now it can go on regardless of the temperature.

By **J. S. WRIGHT**

WELDING at a lower temperature than 10 F has generally been considered unsound and unprofitable because of improper crystallization and cracking. Prior to Pearl Harbor, all shipyard welding would stop when the temperature of the metal dropped to below ten above zero. Why this is no longer necessary can be quickly seen through a brief study of the accompanying diagrams.

In Fig. 1, labeled "proper crystallization," we can see how the solid crystals form progressively from the molten weld metal when the plates are at the proper temperature. The crystals start growing from the root of the weld. Since the weld metal solidifies from one line, it is solid and free from cracks.

Improper Crystallization

In Fig. 2, the diagrams labeled "improper crystallization caused by excessive cold," we find that crystallization starts from two distinct planes, which in this fillet weld are at right angles to each other. The result is a crack down the middle of the weld. As the diagrams show, the crack makes its appearance with the first crystals and it continues to exist after the crystallization has been completed.

Fortunately, improper crystallization only takes place in weld metal at a temperature of 10 F or lower. Hence the solution to the problem is simply to raise the temperature of the plates above this critical point and to keep it above 10 F until the weld is completed.

Preheating Not Enough

We can do the first part very easily by preheating. Generally, a large oxy-acetylene torch is used to bring the plates to the proper temperature for welding. This alone, however, is not enough for successful cold-weather welding since the plates will cool before the weld can be completed. Something is needed to supplement the torch, and for this purpose we are now using electric heating pads.

After preheating the plates with the torch, the electric heating pads are placed three or four inches from each edge of the joint as shown in Fig. 3. They serve as a "heat block" and thus prevent the frost in the plates from chilling the preheated area. The heating pads, it should be noted, do not preheat the weld area; they serve only to prevent it from losing its heat. But that's enough to make the difference between successful and unsuccessful cold-weather welding.

This is merely another of the many applications of American ingenuity which have made it possible for our war production to astound the world and help to smash our enemies on every battlefront.

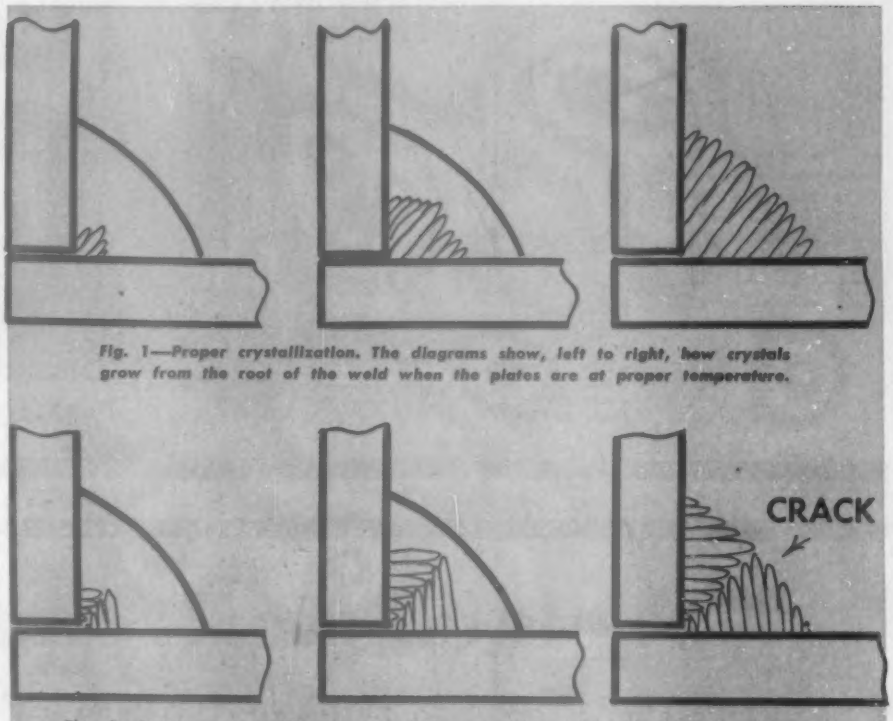


Fig. 1—Proper crystallization. The diagrams show, left to right, how crystals grow from the root of the weld when the plates are at proper temperature.

Fig. 2—Improper crystallization caused by excessive cold. Note that crystallization starts from two planes and hence there is always a crack down the middle of the weld.

Fig. 3—In this butt weld, electric heating pads are used to keep the preheated area from cooling before the weld can be made. The pads alone cannot preheat the plate, and they are not used for this purpose.

Fig. 1—Entrance to the Moffat tunnel at East Portal, altitude over 9,000 ft. The tunnel will be buried by almost a mile of mountains before it emerges on the other side of the Rockies.

Welded Railroad Rails

★ Part Two—The trend to the all-welded continuous rail is growing by leaps and bounds. The second installment of this new series tells how thermit welding was used to join the rails in Colorado's six-mile Moffat tunnel.

By CLYDE B. CLASON

Gapped joints between railroad rails will have to go when increased train speeds demand continuously even rail surfaces to provide shock-proof transportation of both freight and passengers. Last month's article explained why the expansion caused by temperature increases is not a problem of the all-welded continuous rail and described the fundamentals of the oxy-acetylene pressure process, one of the three methods that may be used for rail welding.

The present installment is devoted entirely to thermit welding, with emphasis upon a particular job—the Moffat tunnel. The third and final article will discuss the flash-welded rail and the application of this process.

TODAY'S heavy freights, high speeds and crowded train schedules are hard on railroad track. Particularly are they hard on rail joints. The incessant pounding of locomotive drivers and car wheels causes rail ends to become battered and cupped. It also causes bolts and bonds to work loose, affecting the line and surface of the track. All of this means that much work must be done to keep the track in order.

Maintenance Excessive

The maintenance of bolted rail joints is costly to the railroad. Although joint bars extend over no more than 7% of the length of a road, they make necessary at least half of all track maintenance work. Various studies made by the committee on economies of railway labor, AREA, have shown that approximately 65% of track labor is chargeable to Account No. 220, "Track Laying and Surfacing," and that about 75% of this charge covers labor used at or in the vicinity of the joint. Thus almost 50% of the total track maintenance expense can be traced directly to the rail joint.

When railroad rails are welded, the above maintenance charges diminish almost to the vanishing point. In addition to the very substantial saving in track maintenance, welding also increases rail life through the elimination of end batter. Furthermore, the welded rail gives better conductivity in track circuits, decreased wear and tear on locomotives and rolling stock and a smoother riding track. The latter means quieter operation, greater passenger comfort, lessened damage to freight through shock and vibration.

Tunnel Problems

In tunnels, the usual problems of bolted rail are amplified by a confined

atmosphere of constant moisture and corrosive exhaust gases. Electrolysis often develops, and joint bars, bolts and bonds soon become corroded and must be inspected and replaced frequently if accidents are to be avoided. In Colorado's six-mile Moffat tunnel, in particular, this excessive renewal had reached the point where track maintenance costs were so far out of line that something simply had to be done about it.

The Moffat tunnel (see Fig. 1), on the Denver & Salt Lake Railway, is one of the most remarkable pieces of railroad engineering in the United States. Perhaps it would be safe to say *the* most remarkable. Its 6.2 miles pierce the Rocky Mountains at an altitude of more than 9,000 ft and save just 156 miles of the detours and zig-zagging that used to lengthen the journey interminably between Denver and the Utah capital. At times the big man-made bore passes almost a mile beneath the mountain peaks towering in snow-covered grandeur above it.

After careful analysis of the tunnel's track maintenance problem, the railroad's engineers decided that it would be necessary to do away with all bolted joints by welding the rails in continuous twin lengths stretching from portal to portal. To do this job, the thermit-welding process was chosen.

An Old Method

Rails have been joined by thermit welding ever since the opening years of the present century. Street-car rails, to be sure; railroad rail welding (as pointed out last month) was not introduced until 1930. Street railways, however, have had more than a third-of-a-century's experience with welded track, and today practically every sizeable city system in the world welds its rails as a matter of course when new track is laid.

Parenthetically, it might be stated that two circumstances were mainly responsible for the early adoption of rail welding by street railways as well as for its continued use: (1) the surrounding pavement has to be torn up each time a rail joint requires attention and (2) the pavement protects the welded rail to some extent from extreme variations of temperature and helps also to hold it so firmly in position that there is little danger of track buckling and similar troubles.

The history of street-car rail welding is also the history of the thermit-welding process. It is estimated that 85% of all the rail welding being done on street railways today is thermit welding. The reasons for the popularity of this process lie in its comparative simplicity, the small size and portability of the equipment, its ready adaptability to varying working conditions and, finally, to the fact that the thermit weld entirely eliminates the gap between rails and provides a continuously smooth steel surface for car wheels to travel upon.

Fig. 2—Welding bed at East Portal. The men are aligning the rails in preparation for welding.

Fig. 3—Set-up for making four thermit welds at a time. The two welds without crucibles have been poured; the others are preheating.

Back to the Tunnel

No better way to describe the application of the thermit-welding process to railroad rails can be found than to outline in detail the various steps undertaken in the Moffat tunnel job. The pictures reproduced are "stills" from the motion picture "Thermit Rail Welding of the Moffat Tunnel," produced by Metal & Thermit Corp. with the coöperation of the Denver & Rio Grande Western and Denver & Salt Lake railways.

Welding Bed

The timber structure you see in Fig. 2 was built outside of the tunnel entrance at East Portal (Fig. 1). It provided both a storage place for unwelded rails and a bed for aligning and welding them into continuous lengths of 1,000 ft each.

Fig. 4—Close-up of crucible, mold box and rail clamp before the thermit reaction. The ring toward the bottom of the crucible prevents molten metal from spattering into the mold.

Fig. 5—Pouring the thermit steel.

The operation was set up on a production basis, and work progressed on four strings simultaneously. Thus the welds were made in groups of four. In Fig. 3 we see the set-up for making four thermit welds at a time. Two welds have been poured (no crucibles) while two are in the final stages of preheating.

As each group of four thousand-foot strings was completed, it was moved aside for later transfer to the tunnel and another group of rails was moved in place for welding.

Must Make Molds

Thermit welding differs from all other types of welding in that it requires a mold for the welded joint. Hence the first step in the procedure was to make a split mold box. Each half of the mold was formed on a pattern having the exact contour of either the right or the left side of the rail being welded. One half of the box was placed over the right-side, the other half over the left-side pattern. Other separate patterns were inserted to form the necessary heating gates, vents and risers.

A little molding material was first carefully packed about the patterns to hold them in place; then the entire box was filled. The molding material was rammed in solidly until the box was full. The patterns for the gates and risers were then withdrawn, and the completed mold was lifted off the rail patterns and trimmed to remove all sharp corners or any rough edges.

Alignment

Before applying the mold box to the joint, the rail ends had to be lined up carefully and secured by a simple clamp (Fig. 4). This clamp held the rail ends in proper alignment throughout all subsequent steps of the welding procedure. After a final check on alignment, the clamp was tightened and the joint was ready for the mold.

Handling the mold gently to avoid breakage, the operator placed it on the rail. He centered it just above the joint and fastened it firmly with clamps at top and bottom.

Fig. 6—Removing the clamps. The mold box has already been taken off. The slag and excess metal will be cut away by torch before grinding.

Crucible Preparation

Next, the crucible had to be made ready to receive its charge of thermit. A magnesite thimble was rammed into the bottom, and the tapping pin was thrust through an asbestos washer and dropped through this thimble. A metal disc and a small amount of a granular refractory plugging material were placed above the tapping pin.

The thermit came packed in bags, one of which held just enough to make one weld. A small quantity of the thermit was first allowed to trickle gently into the bottom of the crucible, extreme care being taken in order not to disturb the plugging material. The remaining contents of the bag were then poured in.

Since thermit will not ignite at a temperature below 2,800 F, a special ignition powder has to be used to start the reaction. On top of this powder are placed match heads to ignite the igniter.

In Fig. 4 the crucible, covered with its cap, is ready for the reaction. Note the ring which prevents any of the molten metal from spattering into the mold.

Preheating and Ignition

Preheating is a necessary part of the thermit-welding process. Besides

bringing the rail ends to the proper temperature, preheating also serves to dry out the molds. Here a preheating torch was used. When the rail ends had been brought to red heat, the preheater nozzle was removed, the mold vents plugged and the heating gate quickly closed and backed with molding material. Then the match heads were touched with a red-hot rod in order to initiate the thermit reaction.

The superheated molten steel and slag produced by the reaction were tapped into the mold (Fig. 5). The molds were so constructed that the thermit steel would run into a torch-cut gap between the rail ends, while the lighter slag would float in the basin at the top.

As soon as the weld had cooled, the mold box was removed. The weld now looked like the one in Fig. 6. The excess metal formed by the pouring gate was cut away, and the weld was ready for inspection and finishing.

Gamma-Ray Inspection

On the Moffat tunnel job, all of the welds were examined by means of radiographs produced by gamma rays from radium. This was deemed necessary because a new design of weld was being installed. The film was placed on one side of the weld and a capsule of radium on the other (Fig. 7); the gamma rays passed through the welded joint, exposing the film. The "shadow picture" that resulted quickly showed up any defects such as porosity, slag inclusions, lack of fusion and cracks.

Radium, which can be rented by the month or the year for a reasonable sum, is ideal for such applications as this where there are no power lines for X-ray equipment. There are some problems in its use, not the least of which are the precautions which must be taken in handling (note the red danger flag in Fig. 7). The exposure time is a function of several variables —film-to-source distance, milligrams of radium in the source, thickness and density of the material being examined. All of this sounds complicated, but the proper exposure time can be quickly calculated by means of special slide rules and other devices developed for this purpose.*

Fig. 7—Gamma-raying the weld. The "shadow picture" produced on the film will quickly reveal cracks, slag inclusions, porosity or other defects.

Finishing, Track Laying

After passing the gamma-ray test, each weld was ground to proper contour on both the running surface and the gauge side of the head. This involved two operations and two pieces of equipment. A precision grinder (Fig. 8) was used on the running surface, after which the sides of the head were smoothed with a flexible-shaft grinding wheel as shown in Fig. 9.

After several thousand-foot lengths had been completed, the long, long strings were moved from the welding bed and spiked in pairs to ties placed crosswise on the track leading inside the tunnel. Plates were fastened to the bottoms of these ties to provide riding surfaces that would permit a small locomotive to skid the long welded sections into the tunnel. Each string was dropped into place, spiked and temporarily joined to the adjoining rail section by means of heavy track clamps. When six or more thousand-foot lengths had been placed, the tunnel was closed to other traffic while the welding crew were transported inside to make the final welds.

Closure Welds

The closure welds were made in exactly the same way as the welds outside, except that they had to be hurried somewhat in order to avoid blocking the tunnel for any longer than necessary. The steps involved in each weld were the same as those previously described: lining up the joint, applying the mold, preheating, reacting the thermit and tapping the crucible.

The closure welds were allowed to cool only long enough for the weld metal to set. The clamps and mold boxes were removed while the weld was still hot. The excess metal was also cut away before the weld had had time to cool, and the grinding was begun immediately afterwards.

All of the work on the Moffat tunnel job was done by the railroad's own welding crews, under supervision of representatives of Metal & Thermit Corp.

The January issue of THE WELDING ENGINEER will tell how the flash-welding process is used to produce continuous rails.

*See "Gamma-Ray Testing of Welds," THE WELDING ENGINEER, September, 1942.

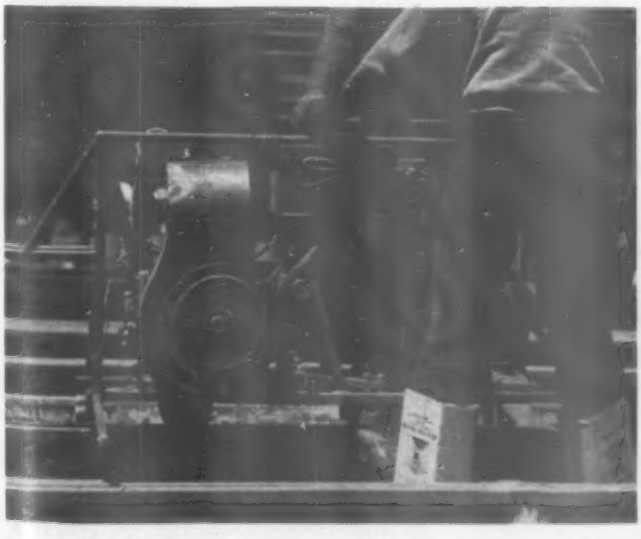


Fig. 8—Grinding the running surface with a heavy precision grinder.

Fig. 9—Grinding the side of the head with a flexible-shaft grinder.

Spot-Welded Parts

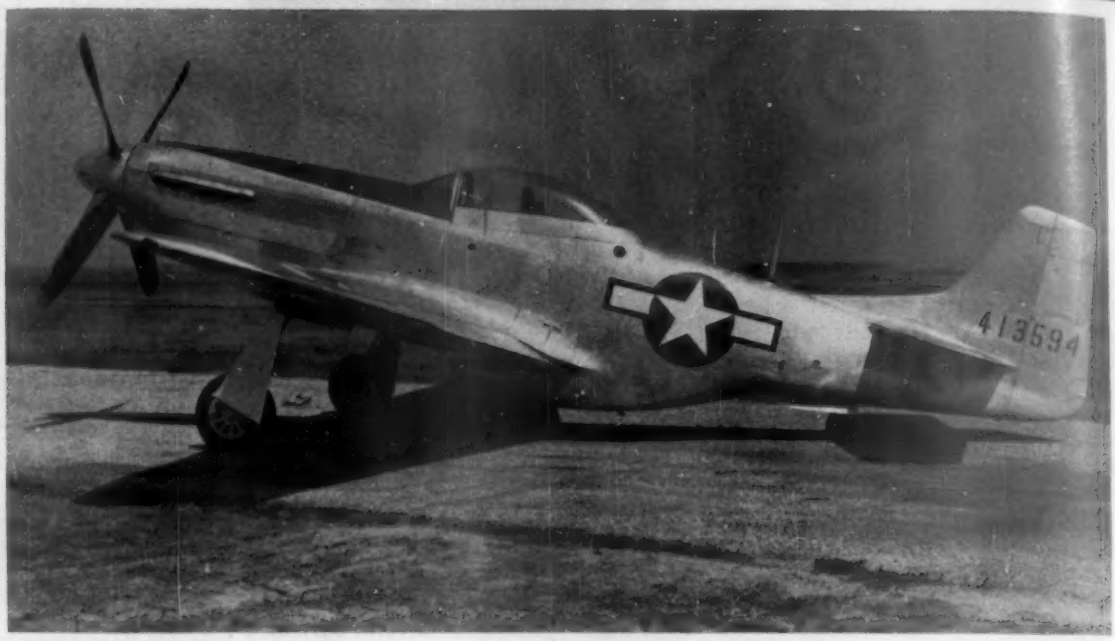


Fig. 1—North American's P-51 Mustang fighter, world's fastest airplane, has about 300 spot-welded assemblies. Outstanding examples of these are the air scoop and dorsal fin that are shown in Figs. 2 and 3.

THERE are about 300 spot-welded assemblies—representing about 30,000 welds per airplane—on the P-51 Mustang (Fig. 1), fastest airplane in the world. The North American Aviation, Inc., main plant has gone far in spot welding on its own designed and fabricated P-51, which is perhaps more extensively spot welded than any other airplane of aluminum-alloy construction. Its bottom, external and internal air scoops, everything forward of the fire wall in its cowling, even the wing tips, are at present all spot welded.

Spot welding offers many advantages in economy compared with riveted construction. The North American experience is that it costs 0.2c to spot weld as compared with a 5 to 8c cost (depending upon the location) per rivet. There are thousands of rivets in an airplane. Spot welding eliminates weight, creates a flush surface which gives added speed to the plane. It is neater and can be adapted to a restricted fabrication space, which is difficult in riveting procedure.

North American has a counter on each machine and maintains a detailed estimate of spot-weld savings involved, the motive of management being to deliver a greater poundage of functionally fit airplane per government dollar. North American plans call for the progressive extension of spot welding. Presently, from 10 to 15 new spot welding jobs per week are being sent to Contact Engineering for change from rivet to spot weld. The confidence Engineering has in this process has been enlarging fast, as spot-welding procedure has developed centralized control.

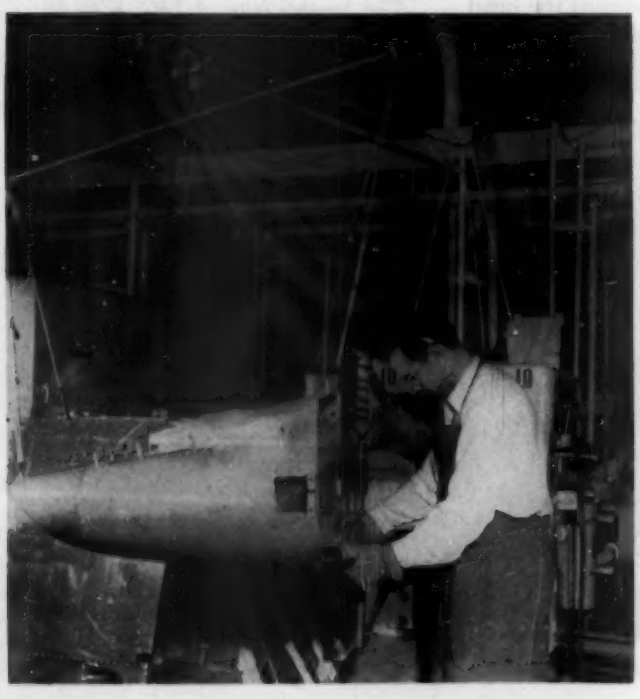


Fig. 2—Spot welding of the air scoop is facilitated through use of the overhead conveyor service at each machine in the Inglewood plant. A helper was required to hold the part before the North American company adopted overhead service.

Types of Welders

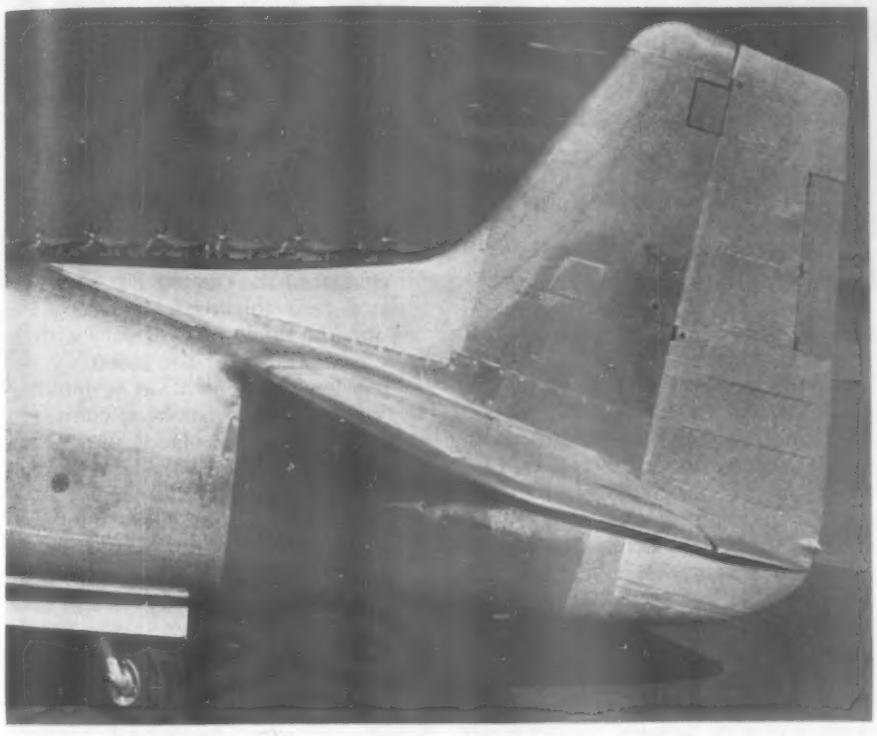
North American's Inglewood plant now has a centralized spot-welding department which employs all three types of welders: (1) electrostatic, (2) electromagnetic and (3) alternating current. The diversity is largely caused by lack of availability of equipment and the necessity for finding a welder of any type that would fit particular jobs. There are 50 spot-welding machines, of which 25 are a-c, 15 electrostatic and 10 electromagnetic.

Spot welding is at present being largely applied to work concerning secondary structures; *i.e.*, those which do not play a vital part in the strength of the air frame. However, its use is being extended to primary structures, which take the direct load and represent highly stressed parts. This can be done because of the far better welder controls now available as well as improvements in fixtures and procedure plus a better trained personnel.

for P-51s

By GERALD ELDRIDGE STEDMAN

North American Aviation has brought spot welding to a fine art by a planned progressive layout plus careful consideration of such details as overhead conveyors, plastic fixtures, chemical cleaning methods, standard machine settings, visual and metallurgical inspection.



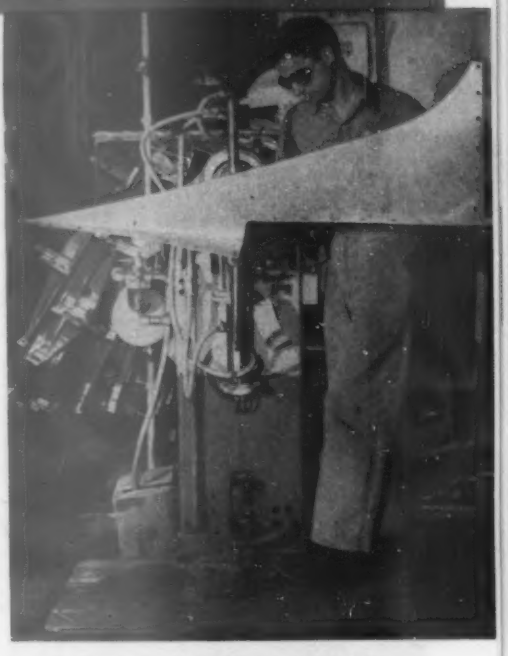


Fig. 3—The dorsal fin, a recent modification, is one of the important spot-welded parts on the P-51 Mustang fighter. Left: the dorsal fin as it appears on the airplane.

Specifications

Formerly, the "heat-pressure-and-time" specifications in relation to varied gauges of metal contained so many variables as to lose meaning. Engineering tended to question etching and other material preparation, the maintenance of standards and the condition of the welding equipment. The centralization of supervisional operations within a special department and improved machine maintenance have permitted the definition of standardized settings without variations. These "qualification sheets" and engineering manuals have established detailed specifications as to (1) center line of the spot-weld row plus control of expulsion and cracked welds, (2) spacing of welds and location, (3) location of tack rivets, (4) shear strength values per gauge, (5) type of aluminum or steel.

Tooling has been quite amazingly improved. A departmental layout has been achieved (after careful methods engineering) that has made real contributions to efficiency. Developments in offset electrodes to get into recesses, removal of many of the limiting factors in welding aluminum because of cooling, the simplification of complicated extensions that produced deflection . . . these and other factors have given Engineering an enthused confidence.

Spot-Welded Parts

It has been estimated that 60% of the P-51 Mustang can be spot welded and that tends to be the new goal. Gun doors, air scoops (Fig. 2), dorsal fins (Fig. 3) and all the front nose cowling are now spot welded, and more integral assemblies are receiving consideration. Shear values can now be guaranteed for certain combinations under the standard practice that has been evolved, and complex variables have been brought under such control that a revolutionary extension of spot welding to primary-structure fabrication can be expected.

The refinement of departmental layout has jumped spot-welded production by establishing excellent traffic flow with proper supervisory control. Manpower per machine has been drastically cut by the design and use of flexible fixtures to hold the part and by the standardization of overhead service (Fig. 2).

Departmental diffusion throughout the plant is never wise in spot welding. A centralized and progressively sequenced layout is essential to win control and establish the engineering constants required. Since central location involves traffic, the need for overhead conveyors is axiomatic. These are now being engineered.

Among my 281 plant contacts the country over since Pearl Harbor, I have found none that has gone so much overboard in tooling for spot welding as this Inglewood plant. The lightweight spot-weld tooling being originated represents a significant development.

Plastic Jigs

William Smith, general foreman of processing, plating and heat treat, is also in general charge of spot welding. This central department has undertaken a complete revision of tooling on spot-weld assemblies, replacing former heavy, cumbersome steel jigs with newly designed dural, phenolic fibre and plastic cast fixtures. These have the advantages of being light in weight, durable, simple-acting and non-magnetic. The substitution of dural and phenolic fibre for steel involves no mere change-over in the

Fig. 4—Weighing only one pound, this phenolic fibre jig greatly simplified the spot welding of a part formerly held in a heavier, more complicated steel jig.

type of material used in the construction of jigs. There is also a chance for improvement in fixture design.

An example of the latter is provided by an old spot-welding jig which employed ten clamps. It represented a complex contour fit. To install the work required four movements of four positioning clamps and six movements of six securing clamps. Work removal was just as complicated. The fixture was of steel and weighed eight pounds. When positioned, the work was inaccessible, necessitating breaks in the welding cycle.

The New Design

The new jig (Fig. 4) is very simply designed, being positioned by one movement into a slot and secured by six movements of three positioning clamps. The fixture is of phenolic fibre and weighs only one pound. There is simplified gauge control. The part is inverted for work positioning. The work is rapidly charged and discharged in the fixture in a simple, efficient manner. Spring tension on the clamps compensates for variations of positioning fit. Finally, the new jigs were produced in 8 hours; the former jigs in 50 hours.

Such fixtures as this are worthy of the best tool design, and North American is giving them just that.

Casting Procedure

The use of plastic materials for jigs and fixtures requires a new and different procedure. Mr. Smith explained it in this way:

"The first step in plastic casting is to prepare a plaster mold of the assembly for which the jig is to be used. This mold is used as a holding device for the assembly while the laminated plastic cast is being formed. It may also be used to obtain the correct contour of the assembly.

"After the plaster mold has been made, it is necessary to coat the surface of the assembly with two or three layers of lacquer, allowing sufficient time between coats for thorough drying. Next we place the lacquered assembly in the plaster mold for the purpose of building up the desired laminated cast around the lines and contours of the part. The plastic mixture can be mixed in any container that is not affected by acids. In the mixing of this plastic for laminating purposes, we use 10 parts astrolic resin and 1 part catalytic agent. Fibre glass or glass cloth is employed as a filler or binding agent, its function being to strengthen the plastic case.

Building up the Cast

"When the plastic resin has been thoroughly mixed and is ready for use, the liquid plastic is applied in a thin coat to the part—this is best done by direct use of the hands. Next the operator adds one sheet of glass cloth and molds it carefully with his fingers to the contour of the part. A second coat of liquid plastic (Fig. 5) and another sheet of glass cloth are added and again formed into the desired contours. The cycle is continued until the casting has been laminated to a thickness of from ¼ to ⅝ in. The thickness will vary with the size and weight of the assembly.

"When the lamination or building-up of the casting has been completed, the whole thing is placed in a hot-air oven (Fig. 6) and baked for 2 hours at approximately 175 F.

"On completion of the baking process, the casting is removed from the oven and the plastic cast taken off very carefully to avoid damage (Fig. 7). Cutouts are then made in the casting to give the desired accessibility for spot-welding operations.

"This type of fixture results in the saving of time, labor and material. It is easy to manufacture, lightweight, simple-acting and non-magnetic.

Aluminum-Cleaning Methods

North American's practice places important emphasis upon proper sur-

Fig. 5—A coat of plastic resin is applied to each glass cloth to build up the laminated casting for the spot-welding fixture.

Fig. 6—After the plastic cast has been molded to the part, it is placed in a hot-air oven and baked for two hours at approximately 175 F.

Fig. 7—After baking, the plastic cast is carefully removed from the assembly to avoid damage. Cutouts are then made to give the desired accessibility to the part for spot-welding operations.

face preparation of materials. Both an aluminum cleaner and a hydrophosphoric etch are used, the latter relatively little. The first cleaning method is used on all aluminum alloys of any gauge or hardness, in detail or assemblies. Exceptions are assemblies containing copper, brass, bronze, magnesium or steel. These metals and the finishes normally applied to them (such as cadmium, zinc or chrome plate, black oxide coating, Parkerizing or paint) are rapidly attacked by the etching solution. For this reason, nut plates, fasteners and similar hardware are not cleaned.

The cycle of Method No. One includes five stages: (1) A five-minute soak in an alkaline cleaning solution (4 oz per gallon of water) at a temperature of 185 F. (2) A hot-water rinse at the same temperature. (3) A 7 to 10 minute soak in acid bath (25% phosphoric acid) at room temperature. (4) A cold-water rinse (Fig. 8) to lessen oxidation tendency. (5) Drying with hot air at 150 F.

The important cautions to operators are: (1) Do not overetch, (2) get the material clean, (3) obtain minimum-maximum control, (4) provide consistent conditions throughout. Excessive oxides are not particularly confounding if they are consistent. Surface preparation has much to do with the control of spot-welding quality, it is believed here.

Standardized Machine Settings

North American has established schedules of settings in the commonly welded gauges for each spot welder. These settings are designed to produce the maximum production of strong, defect-free welds, allowing shear-strength tolerances of plus or minus 10% of the average shear values. This consistency is important in that it assures each weld will withstand an equal share of the load. It is a guarantee that cleaning has been good and that the machine is performing satisfactorily. A spot welder which is so unbalanced as to produce a very strong weld in a group of moderately strong welds is equally as likely to produce a very weak weld in the same group. A deviation of plus or minus 10% in the welding current (or voltage) to adjust for variation in sheet thickness and machine condition is permitted for spot and projection welding, but for roller-spot (seam) welding a deviation in current of only plus or minus 5% is permitted.

Typical Tip Troubles

Excessive fouling of electrode tips may be caused when the tips have not been properly preconditioned. Or the surfaces of tips and/or parts may not be clean. Or the tip may be too small, out of shape or have the wrong curvature. Or cooling water may not be circulating rapidly enough to dissipate the heat. Or, finally, the current may be too high.

Misshaped spots in the form of peanut or crescent weld slugs may indicate that the parts are being held at an improper angle or that the pressure is too high. Radial cracks can develop when the electrode tips are improperly curved or when pressure is too small or current too high. Excessive indentation (defined as that which is more than 20% of total thickness) can be caused by too high pressure, a wrong tip radius or the flat electrode against the wrong sheet.

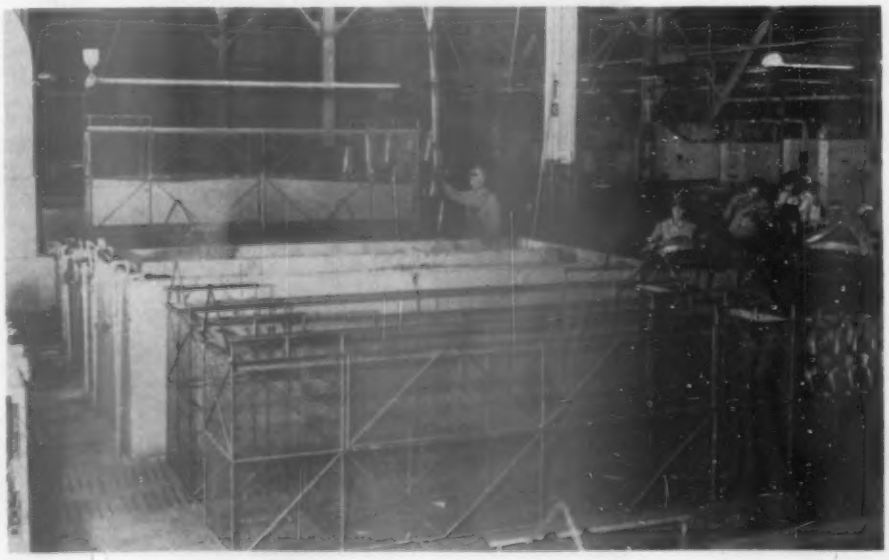
Inspection Procedure

North American has a standard practice of visual inspection designed to discover these faults as well as surface condition, indentation, cracked welds, surface burning, sheet separation, weld spacing, edge distance, weld flashes or spits and expulsion welds in the radius of angles. This inspection is very effective.

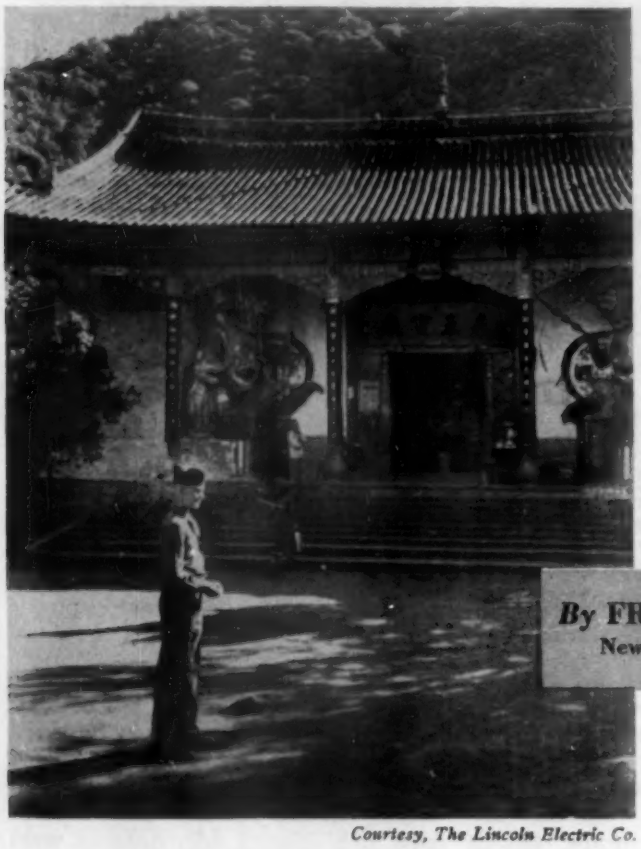
A metallurgical examination of internal weld structure is made in both specimens and typical parts. This covers porosity, Alclad layering, longitudinal cracks, weld penetration, weld symmetry and Alclad sealing.

For a long while engineers and shopmen have been predicting that spot welding will be the ultimate technique in airplane construction. Perhaps such practices as these already form the proof of it.

Fig. 8—Completing the surface preparation of material, a basket of metal parts is dipped for a cold-water rinse prior to hot-air drying.



So This Is China!



By FRED B. BARTON
News Correspondent

Fig. 1—Entrance to the Temple of a Thousand Faces. The two statues flanking the doorway are over 20 feet high.

Courtesy, The Lincoln Electric Co.

PERHAPS you'd like to take a brief look at what China really is like today? Well, sir, it's a place where you learn to enjoy simple things. If you happen to eat your meal off a plate with no cracks or chips in it, you feel lucky. If your coffee or tea comes to you in an uncracked stoneware tumbler, you feel warm all over. The table forks bend easily—not much spring in the tines—and occasionally one will break while you are carving your meat. The meat is apt to be a little tough, too, because all farm animals in China are draft animals, and a cow that pulls a cart for a living can't help being tough to eat.

Temple Visit

So much of China consists of patient little soldiers in faded yellow uniforms and coolies and the families of coolies who carry burdens on a shoulder-bar or drive water-buffalo carts or work long hours in the submerged rice-paddies, that as a visiting soldier you seldom think of that part of China which is scenic. But it is here. Four friends in Army Engineers took me to visit the famous Temple of a Thousand Faces, which is within 20 miles of 14th Air Force headquarters. Too far to walk, but we managed to get a jeep.

Two enormous idols (Fig. 1) greet you as you approach the entrance. Rising behind the temple is a lofty mountain, one of the green peaks of the Himalayas. We climbed this presently and got a wonderful view: clouds and lakes and distant homes of some of China's wealthy and a pervading feeling of beauty and peace.

The temple is difficult to describe without flash-bulb pictures. One huge wall alone has perhaps a couple of hundred life-sized Chinese figures, and probably each one has a story or points out a moral from some favorite Chinese nursery rhyme. I remember one man pictured with legs as long as if he were standing on stilts. Another man had one arm extended about 15 feet in the air as if he were eternally grabbing for something. The facial expressions were ingenious and interesting.

Fig. 2—Sergeant Aubrey L. Goodley (right) and Corporal James A. Ackley who operate a blacksmith-welding shop for Uncle Sam. They are patching up the leaks in a water filter—a 50-gallon steel drum that will presently be filled with charcoal.

Official U. S. Army Photo; Courtesy, The Lincoln Electric Co.

Welding Shop

It's a far cry from an ancient temple to a modern welding shop, but we'll have to leap that gap. The U. S. Army encourages its men to take a personal pride in their jobs. That is the reason for name-signs on desks, and why you will even see signs over workshops like the one in Fig. 2, which reads:

Blacksmith-Welding Shop
Goodley and Ackley

Below the sign, left to right, are

Welding is indispensable to the 14th Air Force—the famous "Flying Tigers" of General C. L. Chennault. Life in China also has other interesting aspects . . .

Corporal T/5 James R. Ackley, 22, of Caldwell, Okla., and Sergeant T/4 Aubrey L. Goodley, 22, of Henderson, Ky. They are the shop. Of course Uncle Sam is the owner and proprietor: puts up the money, selects the customers and furnishes the tools and materials. But considerable leeway in deciding how to tackle a particular job rests with enlisted men like Goodley and Ackley.

Both men learned welding in the Army. "Pop" Swisher, a veteran weldor from Columbus, O., taught them the ropes. "Pop" is about 46 and is out of the Army now through a medical discharge.

Water Supply

You see these two men "fixing" a water-filter, and you can suppose that the 50-gallon steel drum will presently be filled with charcoal and the water allowed to clear and to settle as it trickles through. They use these empty gasoline drums for lots of different purposes over here in China. Put several of them on a high platform and connect them up with piping and you have a water tank. The water is generally dipped from an open well by various Chinese coolies and carried in two wood buckets suspended from a shoulder-bar straight up the ladder. Now and then a hand pump does the lifting but not often. Machinery of all kinds is scarce here in China!

These coolies are amazing workers. Women as well as men work, sometimes carrying a baby strapped to their backs (see Fig. 3) while they pick up stones in their shallow baskets and load them on a pony cart. They smile easily, usually holding up a thumb in the Winston Churchill gesture and saying "Ding-how"—OK, very good—when you say ding-how. The women do not much care for having their pictures taken; they seem to think it robs them of some of their personality.

Everything in China is paid for on a basis of weight. A day laborer, man or woman, engaged in helping build an airplane runway gets paid for each basketload of gravel he carries, thousands of them. Foodstuffs, too, are paid for by weight. Incidentally, China grows amazing crops, due to its well-cared for irrigation systems and the habit of keeping the soil fertile by restoring to it every possible ounce of human manure. You would be surprised, for instance, to encounter corn-on-the-cob, fresh tomatoes, fresh peaches (usually picked too green and hard), cucumbers, watermelon and eggplant here in China.

Putting Them Together

A shipment of trucks arrived from India the other day. Perhaps you have read* how the Army tears these big 6x6 trucks down to the bare bones, loads them in pieces into the cargo planes and carries them "over the hump" (Himalayas). A 6x6, by the way, means six wheels and six drives. These trucks are enormous.

The three pictures in Fig. 4 show the job of putting the huge trucks back together again. The main frame is stripped of its engine and wheels. The steel body is chewed completely in half with a cutting torch, to be bolted on and welded back together when the chassis has been reassembled in China. The pictures show how the GIs work in the open sunshine (this part of China has wonderful climate).

Of course anybody who has lived in the U.S.A. during gas-rationing can appreciate that gasoline is scarce all over the world. Foreign countries such as England have now developed various kinds of charcoal-kilns, usually towed on the back of a London bus, which generate fuel as you drive along. For smaller cars you load a bellows on top of the coupé with illuminating gas—enough to drive maybe 15 miles. Well, here in China the big buses have some incredible machinery and gadgets winding all over the front. I don't understand them, sorry to say.

So that is all for the moment from yours truly, over here in China with the 14th Air Force and its attendant Army activities.

* See THE WELDING ENGINEER, October, 1944, page 66.

Courtesy, The Lincoln Electric Co.

Fig. 3—Just like an Indian papoose, this Chinese baby is carried strapped to the back of its mama.

Fig. 4—The truck shown in these pictures is a big six wheeler that was flown in pieces over the Himalayas from India. GIs at 14th Air Force headquarters weld the body together again and reassemble the chassis.

Official U. S. Army Photos, Courtesy, The Lincoln Electric Co.

Shipyard Welding Contest

What better place than the columns of THE WELDING ENGINEER to outline the details of a recent welding contest and its rules? The technical facts are supplied by J. L. York, welding engineer at Brunswick.

By **FRANK W. DUNN**
Brunswick (Ga.) Shipyard,
J. A. Jones Construction Co.

Friendly welding rivals from J. A. Jones' Brunswick, Ga., and Panama City, Fla., organizations line up during a contest recess. Left to right: V. C. ("Red") Gambrell, Brunswick, winner of the men's welding contest; Mrs. Eula Mae Bolding, Brunswick, winner of the women's contest; Mrs. A. B. Walker, Brunswick, alternate to Mrs. Bolding; Mrs. Lurie S. Radford, Panama City, defeated by Mrs. Bolding; L. A. Whitehead, Panama City, defeated by Gambrell.

WHEN Jones meets Jones, a welding contest starts! At least that's what happened in the case of the J. A. Jones Construction Company's shipyards in Brunswick, Ga., and Panama City, Fla.

The story of one Jones trying to keep up with another came about as the result of a challenge shot across to the Georgia shipyard by Raymond A. Jones, general manager of the Florida plant.

Challenge Accepted

In the Brunswick shipyard, the challenge was accepted immediately in the form of counter-proposals backed by what is known to the trade as "cold cash." For the sake of glamour, or perhaps because a third of the tackers and weldors in both Jones yards are women, the ladies were designated the chief contenders. A sideshow contest was, however, arranged for the men. Considerable ballyhoo in both shipyard newspapers promoted the show well in advance of the finals.

Management in both Jones yards had, of course, an eye on the national contests on the Pacific Coast. And more than incidentally, both executive staffs had a hope that competition would boost welding footage in their shipyards.

The local contest paid off. In fact, employees from both shipyards ate it up—to the extent that Brunswick's footage was increased enough to offer a powerful contribution to the yard's record of six Liberty EC-2 ships in 31 days.

The Winner

In the interests of straight reporting, Brunswick took first. Mrs. Eula Mae Bolding, the individual winner, was proclaimed "Atlantic Coast Women's Welding Champion" and is now being backed as a serious contender for top national honors. It is hoped to stage a meeting soon with Vera Anderson, welding champion at Pascagoula, Miss.

To locate the best weldors, inter-yard contests were held. Departmental representatives met—the best from the fabrication shops, platens, shipways and outfitting dock and the pipe shop. Where footage could determine the best and fastest weldor, this method of elimination was used. On the outfitting dock and in the pipe shop, however, the weldor was picked by a foreman to represent his department.

National contest rules for women weldors were used in the yard finals; the rule covered welding equipment, machine adjustment, assignment of workpieces, fitting and tacking of specimens and also personal equipment. A board of referees was appointed to see that the contest was carried out in accordance with the rules, and a board of judges was appointed to determine the scores of the contestants. All of the referees and judges were disinterested parties.

The contest was in two parts: (1) butt-welded test plates and (2) fillet welds. It was carried out at the welding school, which gave shelter from the wind and weather.

Grand Finale

Billed in both Jones shipyards as "The Battle of the Weldors," the actual Brunswick vs. Panama City grand finale was staged in Georgia. Plenty of color was provided. The shipyard band, directed by Christos Vrionides, opened the program with some fine music that soothed the jangled nerves of the officials and yard workers who were waiting the returns.

Frank Poole, shipyard administrative assistant, acted as master of

"Atlantic Coast Women's Welding Champ"—Mrs. Eula Mae Bolding, Brunswick Shipyard. She defeated Mrs. Lurie S. Radford, Panama City Shipyard, in a hard fought contest.

ceremonies and introduced company officials and contestants. General Manager E. J. Kratt and Welding Superintendent W. A. Pierre, Jr., gave short talks, and then "The Star Spangled Banner" got the contest under way.

B. E. Bankston, foreman of electrical maintenance, and a crew of electricians were on hand to hook up the meters to the welding machines and to check all machine settings with the limits allowed by the rules. Referees for Brunswick were J. L. York, welding engineer, and M. J. Schmucky, his assistant. Referees for Panama City were S. S. Howell and C. E. Phillips.

The plates were marked with numbers supplied by the Panama City representatives at the start of the contest, and the numbers were shifted after Part 1, divisions 1 and 2, had been run off. This was done to keep anyone except the referees from knowing to whom the plates belonged.

Men's Contest

While the ladies were given a rest, the men contestants started. V. C. ("Red") Gambrell represented Brunswick, and L. A. Whitehead represented Panama City. Both are speed weldors, possessing the qualities of champions, but "Red" slowly gained on his opponent.

In view of the widespread interest in welding contests, we give a brief summary of the chief rules observed in Brunswick:

Part I. Butt-Welded Plates

Division No. 1: Vertical position weld; 5/32 in., Type E-6010 electrodes. Not less than three passes at a current between 130 and 165 amp.

Division No. 2: Overhead position; 5/32 in., Type E-6010 electrodes. Not less than three passes at a current between 130 and 165 amp.

For each of divisions No. 1 and No. 2, two plates, 6 by 10 by 3/8 in., with edges beveled accurately by machine flame-cutting, were used. Each groove was provided with a 1½ by ¼ in. backing strip of the same material as the plates.

A radiograph was made of each weld (vertical and overhead) after the reinforcing bead had been ground or machined smooth. The radiograph was required to show a sensitivity of not less than 0.010 in. metal density variation. This was shown by placing a step-type penetrameter on the plate next to the weld.

It was the duty of the referee to mark each contestant's test plate so that at the conclusion of the X-raying it would be possible to declare the winner. The referee had no part in judging the plates.

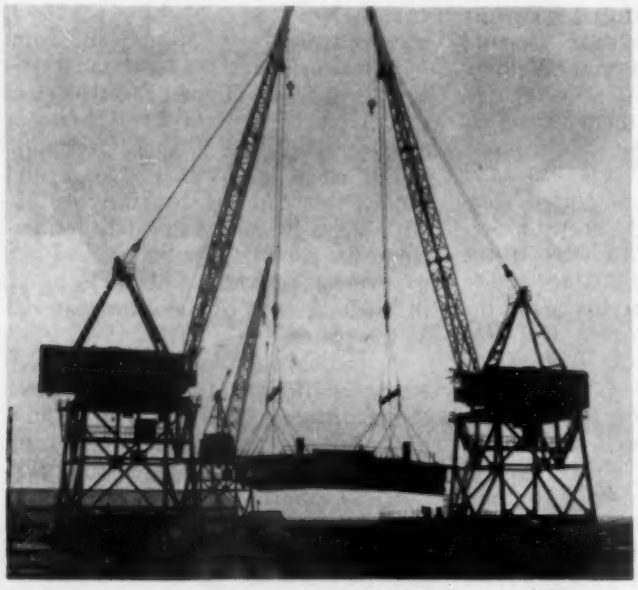
The identification mark and the contestant's name were placed in a sealed envelope, which was given to the judges after they had judged each individual X-rayed plate. No one was allowed to be present at the time of the marking except the two contestants and the referee.

Score Computation

Penetration and fusion could score up to a maximum of 20 points in each division, vertical and overhead, making a total maximum of 40 points. Freedom from slag inclusions could

Welding officials watch every move to guarantee fair play during the contest.

E. J. Kratt, general manager of the Brunswick Shipyard and a vice-president of the J. A. Jones Construction Co., was obviously pleased at the sportsmanship engendered in the welding contest.



Whirleys lift an all-welded deck house that has been prefabricated on the platens.

also score 20 points in each division or a total maximum of 40 points. Freedom from porosity could score up to 10 points in each division, a total maximum of 20. Thus the theoretically perfect score was 100 points.

In determining the overall score of each contestant for Part I, the actual scores for the items given above were added, and the total number of points determined the contestant's final score.

Part II. Fillet Welds

Division No. 1: Horizontal single pass, 5/16 in. fillet welds, E-6020 electrodes.

Division No. 2: Vertical 3/8 in. fillet welds (not less than two passes), E-6010 electrodes.

Division No. 3: Overhead 3/8 in. fillet welds (not less than two passes), E-6010 electrodes.

The test plates were taken from stock accepted as conforming to the American Bureau of Shipping specifications for structural steel for hulls. The plates for both contestants were taken from the same piece of material and at approximately the same general part of the piece. All plates were 1/2 in. thick and of the dimensions specified in the Ingalls rules.

The times were measured with stop watches, starting at the instant when a contestant began welding on any pass or layer. The time ran continuously, including the changing of electrodes and any other interruptions on the part of the operator, until the pass was completed throughout the length of the specimen. Time out was then taken while the pass was being cleaned and brushed and until the contestant had started on the next pass. The total time for each workpiece was the sum of the time intervals recorded for the various passes.

For each of Parts 1, 2 and 3, the time of the fastest contestant was considered as having a speed score value of 100. This time was then used to determine the speed score of each contestant. As an example, Contestant A welds the piece in 960 sec; Contestant B welds it in 900 sec. B's score is, therefore, 100 as stipulated, and A's score is $900 \div 960 \times 100 = 93.75$.

Quality and Economy Scores

Each workpiece was carefully examined and inspected by each of the judges. If, in the opinion of a judge, the workpiece inspected passed all requirements of the American Bureau of Shipping, a score of 100 was entered for that piece. Defects such as undercutting, excess convexity, overlap, etc., reduced the score by an amount reflecting the seriousness of the defect. For any piece, the final quality score was taken as the average of the scores submitted for that piece by the individual judges.

The electrode economy score was computed by determining the total weight of electrodes used by each contestant for each workpiece. In determining this weight, no credit was allowed for stub ends. However, the weight of an appreciable length of electrode left over from welding any workpiece could be credited to the contestant, less 2 in. for the stub.

The electrode economy score was determined for each workpiece in the same general manner as the speed score; *i.e.*, by assigning 100 as the score value for the contestant using the smallest weight of electrodes. For example, Contestant A uses 10.56 lb and Contestant B uses 10.25 lb; 10.25 lb = 100%; A's score is $10.25 \div 10.56 \times 100 = 97.07$.

Total Workpiece Scores

The work of each contestant was judged upon the following points separately: (1) speed, (2) quality, (3) economy of electrode consumption. The workpiece score was determined by a weighted average of the three scores in which speed and quality counted respectively five times and four times as much as economy of electrode consumption. For example, assume that the contestant had a speed score of 95, a quality score of 87 and an electrode economy score of 96. These are totaled as follows:

Speed:	5×95	$= 475$
Quality:	4×87	$= 348$
Electrode Economy	1×96	$= 96$
Totals	10	919

The workpiece score is then obtained by dividing 919 by 10 = 91.9.

In determining the overall score of each contestant for Part II, Fillet Welds, her three scores for each of divisions 1, 2 and 3 were averaged without any weighting, each of the three divisions being considered of equal importance.

The overall scores of each contestant for Parts I and II were averaged without any weighting, each part being considered of equal importance. The theoretically perfect score would therefore be 100.

The contestant with the highest final score determined, as outlined herewith was declared the Champion Woman Weldor.

A 10,500 ton Liberty Ship starts on its trial run—one more unit in the "bridge of ships" being built at the Brunswick Shipyard.

Engineering Serial

Each month, during the past year, Tube Turns' advertisements have pointed out one single outstanding advantage of Tube-Turn seamless welding fittings. Added together, they have told a serial story of Tube-Turn engineering and performance qualities that are of prime importance to everyone concerned with designing, specifying, buying or installing piping and fittings.

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Welding Fittings and Flanges

Short Cuts and Kinks . . .

. . . To the Cause of Victory

A few of the many time and labor-saving ideas developed by tacticians of the production line are presented every month in this department. If you have a good welding idea of your own to pass along, you are hereby invited to contribute it to the cause of victory. Send anything you think suitable to: Short Cuts and Kinks, THE WELDING ENGINEER, 506 S. Wabash Ave., Chicago 5.

Pipe-Welding Fixture

By John B. Crawford

A PIPE-WELDING fixture I devised has been recommended for adoption by the Labor-Management Committee at Calship. The idea of this device is to position pipe for continuous roll welding. It is a rotating jig comprising a faceplate and self-centering expanding arms that grip the pipe from the inside. The arms are adjustable so that any size of pipe from 3 to 10 in. may be handled. The entire fixture rotates in an adjustable bearing, which may be set to any desired angle or height.

The fixture can be easily and quickly adjusted and all of its moving parts are protected from welding spatter. It is constructed so that the pipe may be tipped up at an angle, a feature especially helpful in the welding of slip-on flanges. The pipe is held rigidly in any position and can be rotated steadily and evenly, even when it is out of balance.

The proper positioning and rolling of the pipe enables the use of larger electrodes, which both reduces welding time and increases weld quality. The ease of handling also contributes to the saving of man-hours.

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Pipe positioner. The pipe is gripped and held by the expanding arms attached to the faceplate.

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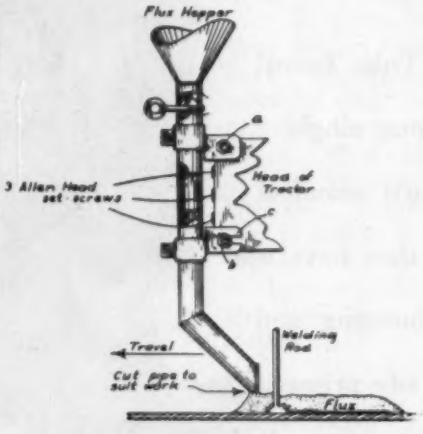

Flux tube and bracket to permit fillet welding on a submerged-melt machine.

Flux-Tube Improvements

A SUBMERGED-MELT welding machine as delivered by the factory to the Oregon Shipbuilding Corp. was not adapted for fillet welding, either with regard to the electrode-gripping jaws or the flux assembly. Furthermore, the machine was so arranged that repair work was inconvenient. It was impossible to make simple changes in the structure that would overcome the defect; fillet welding could not be done without substantial rebuilding of the assembly.

Robert B. Desmond and Ray A. Steiner, supervisor and superintendent respectively of submerged-melt welding, suggested a way out to their local Labor-Management Committee and won a prize for the idea. Their improvement consists in mounting the flux-delivery tube immediately behind the welding rod on a pivotal bracket carried by the head of the tractor. A flux hopper was placed on top of the tube.

The bracket is held by the two bolts marked "*a*" and "*b*" in the sketch. The lower bolt, though adapted to grip the bracket, is arranged through a slot "*c*" so that the whole tube and hopper may be swung about out of position when the bolt is "backed off."

On the head of the tractor there are three Allen head set-screws which require adjustment. Ample space for this purpose is provided between the flux tube and tractor.

All submerged-melt welding machines at Oregon Ship have been changed to embody the above improvement, and as a result some 1,500 man-hours per month have been saved.

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Pipe-Beveling Machine

By W. E. Link

AT J. A. Jones Construction Co., Brunswick, Ga., we had the problem of training some 135 arc pipe weldors and 52 oxy-acetylene pipe weldors. To accomplish this training program in the minimum of time, is was necessary for us to devise some machine that would quickly bevel the pipe required for practice purposes. The lathe we were using was entirely too slow to provide the needed pieces.

An idea which I submitted to the Labor-Management Committee was adopted. This was a pipe-beveling machine powered by a 1/16 hp variable-speed motor. A V-belt from ,the motor drives the main shaft carrying a home-made chuck (see picture). Two chucks were made: one to fit 3 in. pipe and the other 6 in. pipe. A flame-cutting torch installed slightly ahead of the chuck makes it possible to cut any desired degree of bevel. Beveling is accomplished by rotating the pipe while the torch remains stationary.

Since this pipe-beveling machine was built and put into operation, the cost of practice pieces has been cut approximately 75%. In dollars and cents, this means a saving to the shipyard of several thousand dollars. The previously used lathe is freed to do other work, too.

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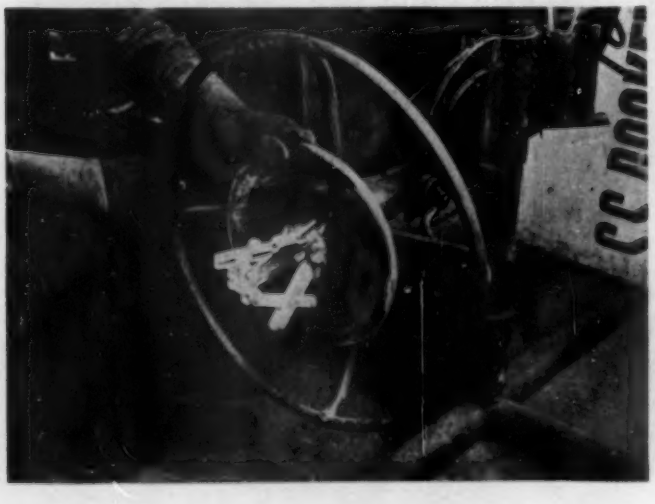
Practice pipe pieces for welding trainees are turned out quickly with this beveling machine.



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In Business for Your Safety

This machine makes possible a more accurate lap joint with a simplified operation.

●

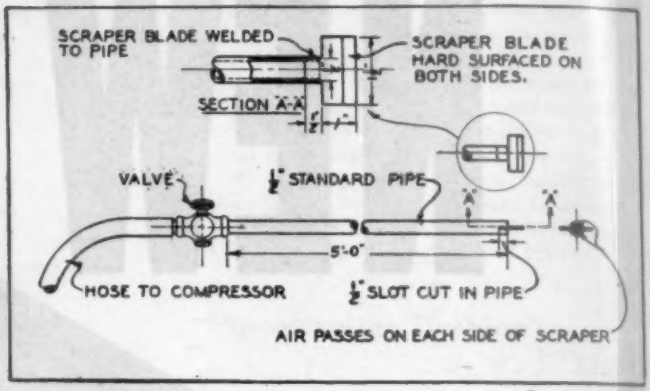
Below: Scraper tool assembly for flame-cleaning operations.

Scraper Aids Flame-Cleaning

By E. A. Quinlan

WHILE demonstrating flame-cleaning on a bridge for a railway company, we devised a handy tool to facilitate operations. It consists of a 5 ft length of ½ in. pipe having a valve at one end for connection to the air line and a slot ⅛ in. deep cut in the other end. A scraper blade 1½ in. wide was fitted into the slot, welded in place and hard-faced.

We used this tool before flame-cleaning with an air pressure of 90 psi both before and behind the blade and removed heavy accumulations of scale and dirt. The remaining scale could then be removed in one pass with the torch, whereas two or three passes would have been otherwise needed. Since air pressure had to be maintained for spraying paint, no additional cost was involved.



Courtesy, Airco

» «

Lap-Joint Cutting

WILLARD J. Robbins, Mardie Gochanour and Glen T. Noyes, workers at the Kaiser Richmond Shipyard No. 3, jointly designed an attachment for cutting lap joints. This device, which was accepted by the local Labor-Management Committee, is applied to the standard flame-cutting machine and consists merely of a tension spring mounted between the sliding bar guide and a small arm attached to the bar. The effect is to cause a constant pressure of the cutting tip against the butt of the lapped plate. A nut is welded to the end of the tip and is turned down to provide a round bearing so that the tip will move smoothly along the butt of the plate.

In cutting a lap joint, any variation in the edge of the overlapping plate should be reproduced in the lower plate in order to obtain a constant gap. Previously, two men had to operate the machine for this type of cut: one turning the gear pinion wheel on the sliding bar while the other adjusted the flame and watched the tip and track. The new method enables one operator to do the job since he does not have to guide the tip, which automatically follows the edge of the plate. Thus 50% of the man-hours used by the old method are saved.

» «

Torch-Tip Reclamation

By W. V. Pruski

FOR some time it was standard practice at the Kaiser shipyard, Portland, Ore., to have the operator make the necessary repairs and adjustments of his oxy-acetylene welding and cutting equipment. The result was that these "repairs" sometimes proved more harmful than beneficial. In particular, welding or cutting tips were often permanently damaged.

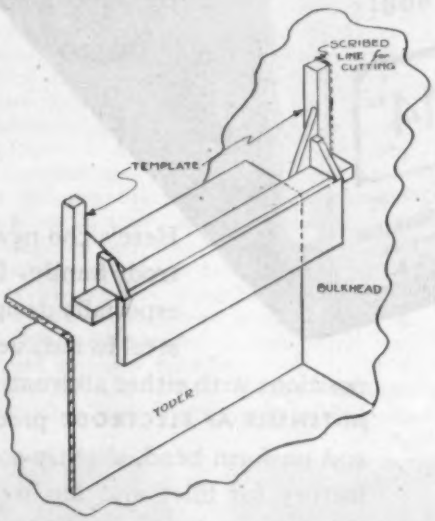
I suggested to our Joint Labor-Management Committee that a tip-reclamation procedure be established, and this suggestion was adopted. All tips are now collected and sent to a shop that has been especially fitted to maintain welding and cutting equipment. The tips are cleaned, repaired and flame-balanced. The institution of the reclamation program has resulted in the salvage of approximately $9,000 worth of equipment every month.

» «

Through-Bracket Template

By Horace F. Craft

THE laying out of through-bracket openings in bulkheads is a time-consuming job. I suggested to the War Production Drive Committee at Marinship Corp., Sausalito, Calif., the use of a template to simplify the task. The suggestion was approved, and a template is now used as shown in the accompanying sketch.



Template for laying out through-bracket openings to be flame-cut in a ship bulkhead.

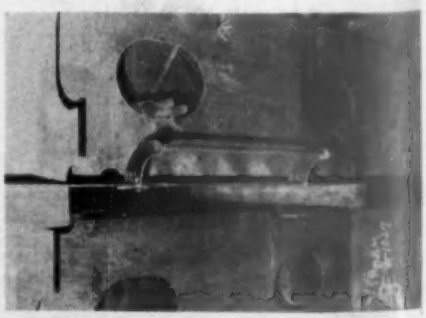
By using a template that slides along on the top of the yoder, it is possible to lay out the holes to be flame-cut in the bulkhead adjacent to the ends of the yoder plates. When a through-bracket is placed through the hole, it will then be in exact alignment on the opposite side of the bulkhead. The template places the cut hole at the correct angle even though the yoder may be tipped, as is the case in the bilge sections.

Weldor's Arm Rest

By Peter Hegge

WELDING overhead, a weldor frequently has a great deal of trouble holding a steady arc. To remedy this, I recently suggested to the Labor-Management Committee at Oregon Shipbuilding Corp. an arm rest that will steady the weldor's arm when he makes an overhead butt weld around a ship.

This arm rest hooks on the deck stiffener, allowing the weldor to rest his arm on it as it slides along the stiffener. The device has resulted in the saving of numerous man-hours, even though it was not primarily considered as a time saver. Its principal purpose is to increase speed and accuracy in overhead welding.



Arm rest for ship weldors who are required to weld overhead. It hooks on the deck stiffener.

Q. HOW TO CUT ROD COSTS AND MAINTENANCE

A. USE ROD SAVER ELECTRODE HOLDERS

1 14% LOWER ROD COSTS

With a Rod Saver electrode holder, rods can be burned right down to the last inch without overheating the insulator. Streamlined design and tapered cap makes tool more accessible to close-quarter work where real rod savings can be realized.

2 50% LOWER MAINTENANCE

Reinforced plastic construction of insulator cap assures extra long life. Tubular form resists heat and breakage. Caps last up to 1000 hours and can be changed right on the job by the welder, without tying up holder in the shop. Quality of materials and simplicity of construction add hours of service to Wells' stingers.

3 OTHER FEATURES

No exposed metal parts to catch spatter...caps held in place by steel spring inside the insulator ...operates on 400 amp. AC or DC...fully ventilated handle has no solid surfaces to catch heat, hence stays cool, adds to hand-comfort.

STUBBY

Model 3RS, 300 Amp. Stubby is smaller—8¼" lighter, 14 oz., only 1¼" diam. Popular with women welders and suited to tight spots.

Exclusive Manufacturer

Martin Wells

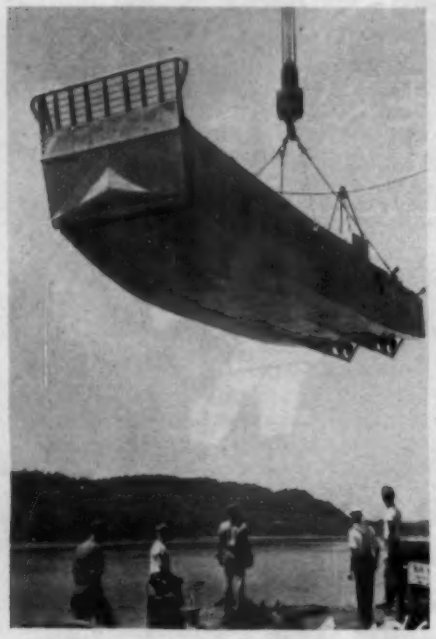
5886 Compton Avenue, Los Angeles 1, Calif.

AIR REDUCTION SALES COMPANY, OFFICES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES

On the Job

Welded Landing Craft

As part of its work in the war shipbuilding program, The American Rolling Mill Co., Middletown, O., is building and assembling the LCM-3 (Landing Craft, Mechanized) for either personnel or equipment. This craft is constructed in two factories in different parts of the country. The 50 ft hull is cut and assembled in one plant while the pilot house, ramps, tanks and ventilators are being built at a second factory. The latter parts are then shipped to the first plant for assembly.



An LCM-3 landing craft being lowered for a test run on the Ohio river, across from the Armco plant in Ashland, Ky.

The bulkheads are first fitted and welded to the sides, and then the various subassemblies are welded into place. A special rotating jig was designed to hold the LCM-3 so that all sections can be welded horizontally.

Completed craft are tested on the Ohio river at the Ironton O., boatyard of the Mt. Vernon Bridge Co.

» «

Welded Wind Tunnel

Welding has been employed to a great extent in the world's largest wind tunnel for full-scale airplane testing, built at Moffett field, Calif., by the Pittsburgh-Des Moines Steel Co. The entire tubular portion of the tunnel, including the test section and the section housing the fans and motors, is of welded plate construction.

Built at a $7,000,000 cost, this giant tunnel is 868 ft long and has a ceiling height of 180 ft. Width at one end is 399 ft and at the other end 353 ft. Unlike the usual cylindrical-shaped wind tunnel the Moffet field structure is box-shaped and has exterior bracing that leaves the interior unobstructed for air flow.

Six 37 ton, 6,000 hp Westinghouse motors produce the man-made hurricane; each motor drives a six-bladed fan with a diameter approximately the height of a four-story building. These huge fans send 24,000,000 cu ft of air racing through the tunnel's 2,150 ft of closed circuit at a rate of more than 200 mph.

The tunnel is large enough for testing planes with wing spans up to 72 ft, which includes all pursuit and fighter planes and even medium bombers.

» «

"Double-Ring" Ceremony

It's a case of "to have and to hold" in the double-ring ceremony shown in the accompanying picture taken at the East Pittsburgh Works of the Westinghouse Electric and Mfg. Co. The upright ring is having an arc-welding treatment to join its ends in a perfect circle while a similar ring—atop still other rings—serves to hold Ring Number One in proper position for the weldor.

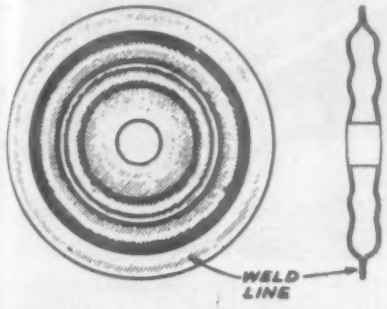
The rings are rims for war-vital 500 hp motors.

The rings hold the ring in proper position for arc welding.

This colossal wind tunnel, a part of the Ames Aeronautical Laboratory at Moffett field, Calif., is the largest of 21 such structures built or under construction by the Pittsburgh-Des Moines Steel Co.

Seam-Welded Diaphragms

INSTEAD of the old method of crimping and soldering the edges, diaphragms for sensitive pressure gauges may now be produced by seam welding. As in many cases where resistance welding has been introduced, a reduction in manufacturing operations was effected. Where before two separate stampings had to be made to allow an extra flange on one stamping for crimping, two sections of the same stamping can now be seam welded together. This has produced a better diaphragm at reduced cost.



Seam-welded diaphragm for a pressure gauge. The sketch illustrates the solution to one of the war problems submitted to the Resistance Welder Manufacturers' Association.

The diaphragms range in thickness from 0.006 to 0.008 in. Formerly of beryllium copper or phosphor bronze, they are now manufactured of stainless steel and Monel.

» «

Cleaning Solvent Tanks

NEVER start to weld tanks in which organic solvents have been stored without rigid preliminary precautions, warns the Safety Research Institute, New York City. The vapors of all organic solvents are toxic, and the majority are also flammable. Oxygen deficiency in the tank is another hazard that must be considered.

The safest method for removing the vapors of a flammable solvent appears to be a thorough flushing with steam followed by mechanical ventilation. In the absence of steam, the sludge may be washed out with a high-pressure hose, but if this is done care must be exercised to avoid building up static electricity. With or without steam, non-sparking shoes and tools, vapor-proof lamps and protective clothing should be utilized during cleaning in accordance with provisions of the Code of Flammable Liquids and Gases of the National Fire Protection Association.

The cleaning of any tank that has contained an organic solvent—flammable or otherwise—should be done from outside if possible. If cleaning from the outside is not possible, the air should be tested by a competent chemist before entry into the tank is made. Workmen who enter should then be protected by air-line respirators of approved U. S. Bureau of Mines design or, in some cases, by canister-type gas masks approved for organic vapors.

BUY WAR BONDS

They Obey The Torch Quickly, Flow Freely, Seal Neatly

★ The purity of the copper (99.96%) and zinc (99.99%) composing TITAN Bronze Welding Rods accounts for the quality and uniformity of the neat bond they provide in continuous trouble-proof performance.

Processed under rigid laboratory controls, TITAN Rods are double deoxidized, contributing further to their excellence, and insuring a constant, free-flowing bond without interrupting faults in the flux. Welds are uniform, sound, strong and ductile.

Made in three groups and seven grades to provide close relationship to the work at hand, TITAN Bronze Welding Rods are the most economical because of the smoother performance and greater output they make possible.

Catalog of all grades will be mailed promptly on request.

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METAL MANUFACTURING CO., BELLEFONTE, PA.
NEW YORK • CHICAGO • SAN FRANCISCO

Quality Alloys By Brass Specialists
Brass and Bronze Rod • Forgings • Die Castings • Welding Rods

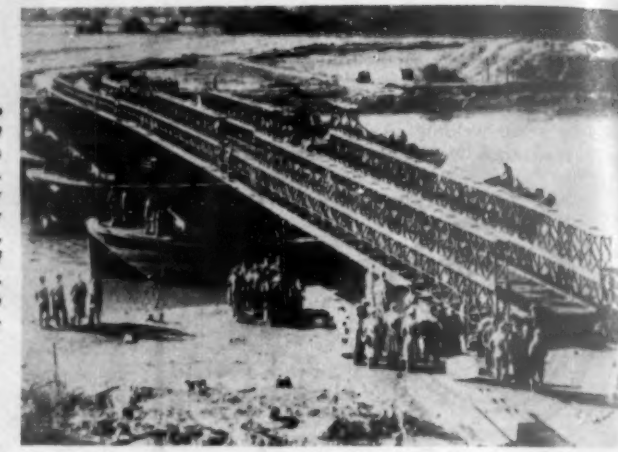
Portable Bailey Bridges

WITH the relaxing of strict military censorship, it can now be revealed that the famous Bailey bridge, originally designed in England, is being prefabricated by several U. S. manufacturers as standard equipment for the U. S. Army.

The Bailey bridge was credited by Field Marshall Sir Bernard Montgomery with much of the swiftness of his advances in North Africa and Italy. The ease and speed with which the bridge can be assembled in the field vastly facilitates the movement of troops in the wake of enemy demolition.

The bridge is built of adjustable struts (appearing as a network in the accompanying illustration). These are approximately 34 in. in length and are arc welded on four sides from ⅜ and ¼ in. plate to form a 3⅛ in. square with clevis bar in each end. Each unit is perforated with 60 pinholes for adjustment.

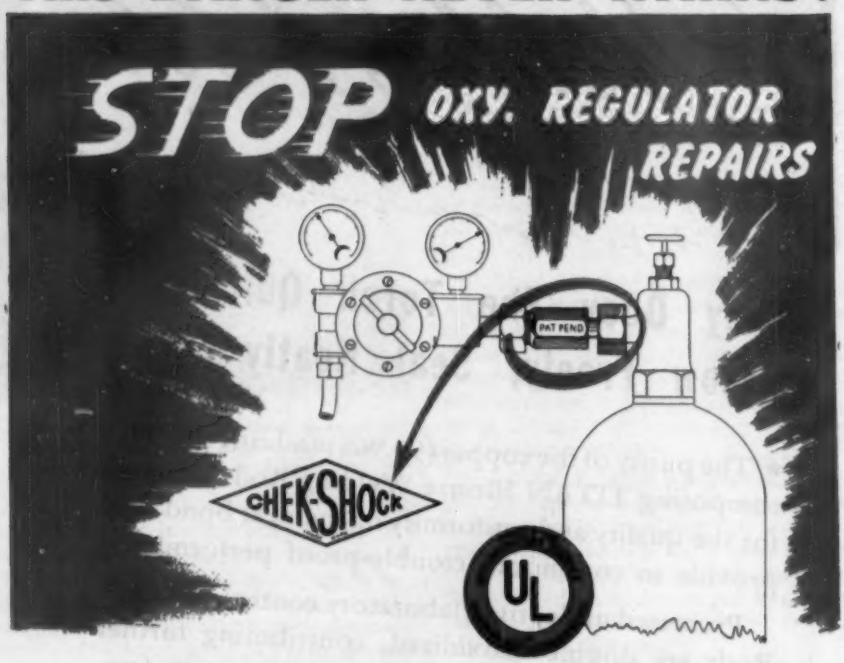
The transom floor beams (foreground of picture) are fabricated by arc welding high tensile steel. These beams are 18 ft long, and 38 of them are used in each bridge section or span.



Retreating Nazis blow up the bridge, but that act of demolition didn't stop U. S. Forces for long. Army engineers simply threw a portable Bailey bridge over the stream, allowing the pursuit of the enemy to continue. Of English design, the Bailey bridge is now being manufactured here.

U. S. Engineers Corps photo; Courtesy, The Hobart Brothers Co.

This DANGER NEVER WARNS!



— CHEK-SHOCK Oxygen CUSHION Valve —

- Will allow tank valve to be opened rapidly without damage to regulator or danger to operator.
- Will prevent unnecessary internal wear in regulator *(as, NOT necessary to release control screw before opening tank valve).*
- Will eliminate possible injury to operator from burstings.
- Will increase life of regulator assembly.

This NEW automatic safety device CUSHIONS the initial BLAST of pressure when tank valve is turned on *(this uncontrolled surge which strikes like a hammer, is the direct cause of most damaged regulators and accidents.)* Thereafter pressure slowly equalizes and then CHEK-SHOCK allows a full flow of oxygen.

ONLY ONE MOVING PART, POSITIVELY FOOLPROOF

PRICE IS LESS THAN ONE REPAIR BILL

Coupler type (will fit any std. size welding type oxygen regulator) ..... $6.00 ea.
Type "A" (for small Airplane or Soldering type regulators) ..... 6.00 ea.
Also made for all types of couplings to fit *MEDICAL* regulators ..... 7.00 ea.

See your distributor or write—

Safety Shock Manufacturing Co.
FOWLER, CALIFORNIA

Handy Rig for Trolleys

A SIMPLE two-wheeled rig is used by the St. Louis Public Service Co. for street-car track repairs. The outfit is carried to the job in the four-wheeled trailer shown in the background of the accompanying picture. Wheels 5 ft in diameter are used to support the 300 amp d-c motor-driven welder.

Courtesy, The Lincoln Electric Co.

Trailer and welder rig for repairing street-car track. Note the pole drawing power from the trolley.

The welder is wheeled on ramps from the trailer and is spotted handy to the track. In the picture, it is being used for repairing worn rail ends by building them up with mild steel electrodes. The power connection to the trolley is made by means of a pole supported by a ½ in. round bar fitting into a bracket built on the side of the welder control box. This bar, which is about 8 ft long, is removed when the welder rig is put back in the trailer.

The trailer contains all welding, grinding and other equipment necessary for the repair of frogs, switches and rail ends.

STRESSES AND OVERHEATING

Worn motor armature shaft resurfaced by Eutectic Low Temperature Welding completely avoiding warping of shaft and preventing destruction of windings by excessive heat.

Heat-treated high-speed steel cutter would be softened by high heat of conventional welding, brazing and soldering methods. Repair at Eutectic low temperatures eliminates need for final rehardening.

Bond metals at temperatures as low as 340° F. Reduce heat consumption . . . cut welding costs!

Now, without resorting to high temperatures, you can gain the advantage of the strong bonds formed by fusion welding.

The most revolutionary welding development of modern times—EUTECTIC *Low Temperature* Welding enables you to join metals at temperatures below the fusion points of base metals eliminating many high temperature hazards of fusion welding and brazing.

Eutectic welding rods and fluxes are available for joining all metals by means of gas—arc—induction—furnace and all standard methods of heating. No extensive training or special skill is required.

Try Eutectic for Production—Salvage and Maintenance welding. Get the facts about Eutectic now . . . Fill in the coupon or write on your company letterhead.

EUTECTIC WELDING ALLOYS COMPANY · 40 WORTH STREET, NEW YORK 13, N. Y.

☐ Send me full information for purchasing *introductory assortment* of important Eutecrods for Production Salvage and Maintenance welding.

☐ Please send me a copy of The Eutectic Catalog IN 1 containing complete information about Eutectic *Low Temperature* Welding and its 6 great advantages.

Name_____ Company_____

Position_____ Address_____

IN BRAZING ANY JOINT WITH FREE-FLOWING PHOS-COPPER ALLOY

You can braze any copper-base joint—butt, scarf, lap or shear—with Westinghouse Phos-Copper at savings up to 76% over other types of solders and brazing alloys. Phos-Copper works equally well in all brazing methods—gas, incandescent carbon, electric furnace, dip and induction heating.

Phos-Copper is a strong brazing alloy that melts at 1304° F. and flows freely at 1382° F. Joints have high electrical conductivity (98%) and for most copper brazing, the use of a flux is unnecessary. No complicated jigs or fixtures are needed in usual operations, and machining and finishing are often eliminated.

Phos-Copper brazing is so fast that man-hours are greatly reduced . . . one manufacturer saved 1520 man-hours. And another cut costs more than 75% by switching to this free-flowing alloy. It is available now for immediate delivery in rod, ribbon and special shapes. Consult your nearest Westinghouse office for complete information, or write Westinghouse Electric & Manufacturing Co., P. O. Box 868, Pittsburgh 30, Pa.

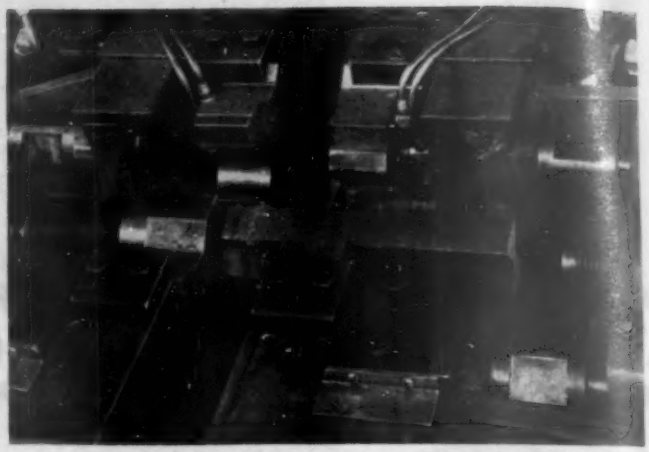
J-90542

- **Free-flowing at 1382° F.**
- **Joints of 98% electrical conductivity**
- **Self-fluxing for most jobs**

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Phos-Copper



Courtesy, Resistance Welder Manufacturers' Association

Flash welding an exceptionally large-size drill. The joint must be strong enough to permit the drill stock to be twisted after welding.

Flash-Welded Twist Drill

SUBSTANTIAL savings in the manufacture of twist drills have been effected by flash welding high-speed drill stock to chrome-nickel steel shanks. The drill stock is welded to the shank *before* twisting— which means that the weld must be fully as strong as the parent metal. After twisting the drill is hardened and finished.

Water-cooled clamping dies hold the stock and shank during welding and also serve as electrodes for the transmission of the welding current. These dies are required to be strong enough to clamp the material at twice the pressure used in the push-up operation.

» «

Welding a Radio Tower

By C. O. Brockett

ONE OF the jobs I recently completed at my shop in Ravenna, O., was a 180 ft radio tower for the sheriff of Portage county. This tower was made up of three 60 ft lengths of steel pipe of ⅛ in. wall thickness.

The structure is of tapered design, using pipes of diameters ranging from 3 to 16 in. The sections were telescoped together and then lap welded at the joints (see picture below). We used 5/32 in. mild steel shielded-arc electrodes, and the entire job was completed in about five hours.

Ladder supports had previously been welded to the outside wall of the pipe sections before we received them. These supports, small cone-shaped pieces with inside threads, can be seen at the left of the picture. They were equally spaced along the pipe in order to anchor the rods for a foot ladder.

Arc welding a structure for a 180 ft radio tower. The pipe diameters tapered from 16 in. at the base to 3 in. at the top. Lap joints were made to hold the "telescoped" sections firmly together.

Courtesy, The Lincoln Electric Co.

They're Going Overboard For Victory—Are YOU?

USE 8-POINT PLAN FOR AN OVERBOARD DRIVE IN THE 6th WAR LOAN!

NOV. 20th TO DEC. 16th

Our fighting men still have a long way to go! But—your plant-wide selling of the 6th can do much to shorten their embattled miles—lessen the price they so willingly pay for victory! Join the coast to coast parade of patriotic firms that are assuring an "overboard" showing in the 6th by following through on every point in the 8-Point Plan.

Start the ball rolling by appointing a **6th War Loan Bond Committee**, representing labor, management and other groups.

Carry on by selecting a **Team Captain**—preferably a returned veteran—for every 10 workers.

Right at the start, establish a **Quota** for each department—and every employee.

Arrange frequent **Meetings of Captains**, highlighting importance of their work—effective sales methods—and need for painstaking study of Treasury Booklet, Getting The Order.

Make definite **Assignments** to those best equipped to arrange music, speeches, rallies, competitive progress boards and meeting schedules.

Issue **Individual Pledge Cards**—made out in the name of each worker and providing for both cash and installment purchase.

Resolicit! This is the secret of "overboard" War Bond subscriptions. Your State Payroll Chairman has a special Resolicitation Plan for you to put into action near the end of the campaign.

Give generously of your **Advertising Space** to drive home the War Bond story.

The Treasury Department acknowledges with appreciation the publication of this message by

THE WELDING ENGINEER

★ *This is an official U. S. Treasury advertisement—prepared under auspices of Treasury Department and War Advertising Council* ★

IN BRAZING ANY JOINT WITH FREE-FLOWING PHOS-COPPER ALLOY

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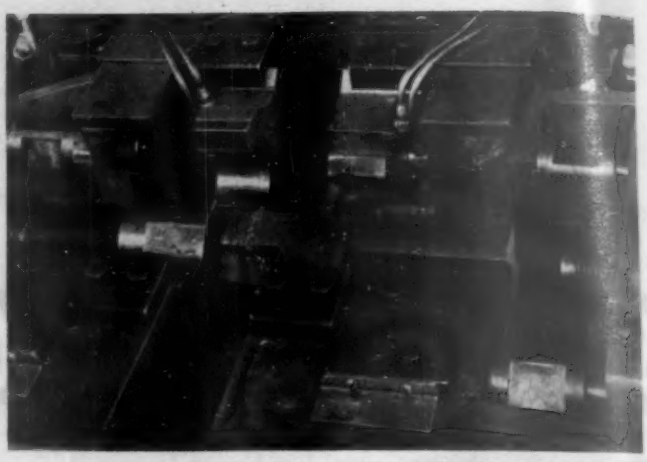

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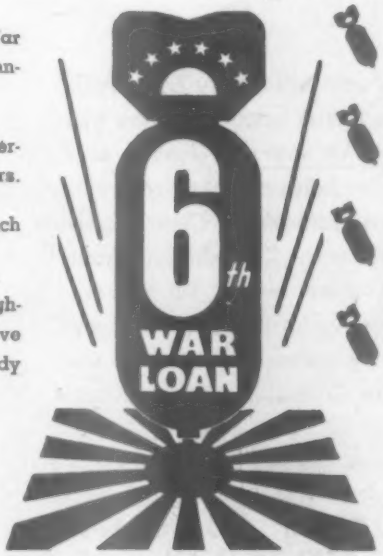

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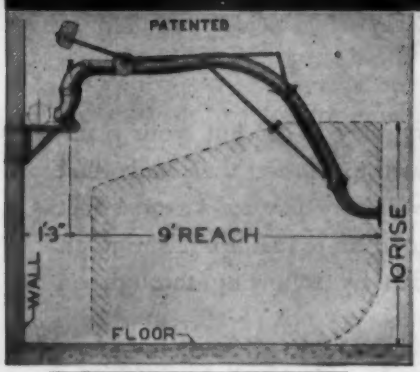
GET RID of WELDING FUMES!



RUEMELIN Fume Collector DRAWS OUT GASES, SMOKE and HEAT *at the Source!*

3 STANDARD REACHES:
3 ft., 9 ft. and 15 ft. radius. Arm extended for maximum reach. Note very wide working range.

Solve your fume problems quickly and efficiently by installing Ruemelin Fume Collectors. Powerful suction draws out noxious gases, smoke and heat *at the source.* Guards employee health, resulting in less welder fatigue, therefore greater plant output. Has many exclusive features: (1) Clears shop air with minimum loss of building heat. (2) Exhaust snout can be positioned instantly and conveniently. (3) Covers maximum welding territory, vertically, horizontally and by circle swing. (4) Shipped completely assembled, easy to install. Thousands of Ruemelin Fume Collectors now serving war industries everywhere.

We gladly offer engineering service for your fume collector installation. Write for Bulletin 37-C.

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3880 NORTH PALMER STREET MILWAUKEE 12, WIS., U. S. A.

RUEMELIN
SAND BLAST EQUIPMENT · TUBULAR DUST FILTERS

Oil-Change Tub

By Charles C. Lynde

THE ORDINARY bucket is too small, the usual galvanized wash tub too light to serve satisfactorily as an oil container when the lubricant must be withdrawn from the base of a big internal-combustion engine undergoing repair. For this job, the weldor for one pipeline company provided a special container built wholly from scrap.

This oil tub was made by welding a section of 24 in. pipe that had failed to pass inspection.

The company was constructing a line of 24 in. pipe and the weldor cut out a rejected section of pipe some 15 in. high. A bottom of light tank plate was cut to fit the 2 ft cylinder and welded to it with inside and ouside beads. Then handles were formed by bending short sections of ⅝ in. bars of reinforcing steel to afford a grip length of some 6 in. The handles were welded down the sides of the circular tub as shown in the accompanying picture.

Since the walls of the pipe are ¼ in. thick, the container will withstand lots of rough service. It may be slid across a concrete floor indefinitely without danger of springing a leak, and it may be tipped up edgewise over the (usually) sharp edge of an engine manhole without danger of cutting the material. When not serving as an oil container, the tub may be used as a cleaning bath for washing small parts or for holding a caustic solution.

» «

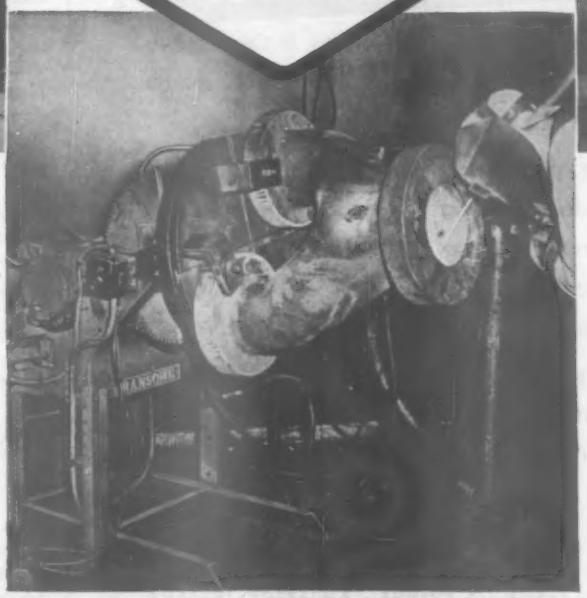
Tarnish Preventative

ONE of the easiest methods to prevent metals from tarnishing during heat treatment is with the use of welding flux. An effective tarnish preventative is a chemical compound developed as a flux for "low-temperature" welding rods. When used to prevent tarnish, this flux is slightly diluted with water and poured into a tank large enough to contain the part to be coated. The entire part is submerged in the mixture, which is agitated to keep the heavier elements from settling. The part may also be coated by immersing it in flux melted in a crucible or furnace. Either way, the flux prevents oxidation and so keeps the surface of the metal as bright and clean as it was before heat treatment.

BUY WAR BONDS

Ransome POSITIONING EQUIPMENT

POSITION WELDING PAYS



Top Illustration — Large Ransome Positioner handling massive heavy gear case weldments.

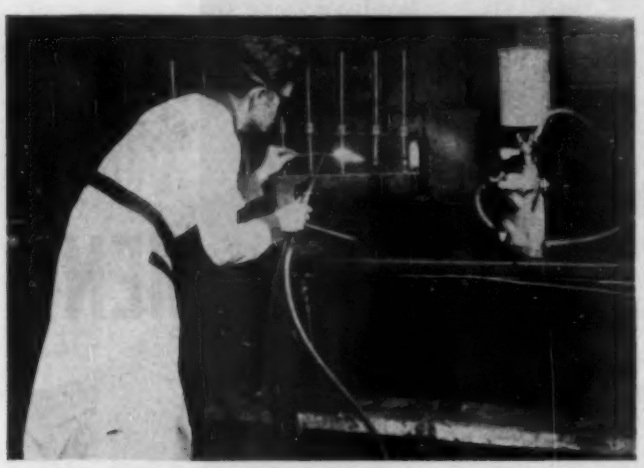
Above — Ransome Turning Rolls for hand welding, note convenient remote control on top of tank.

At Right — Ransome Positioner used for welding operation on pipe work in shipyard.

At Extreme Right — Ransome Turning Rolls used with automatic welding of a long tank.

Ransome Positioners are made in standard sizes from 100 lb. hand-operated to 40,000 lb. power-operated * * * available through a nation-wide distributor sales organization * * Write for bulletin 210A

INDUSTRIAL DIVISION Ransome MACHINERY COMPANY
DUNELLEN, NEW JERSEY
SUBSIDIARY OF WORTHINGTON PUMP AND MACHINERY CORPORATION



A vapor-flux installation for production silver brazing at The Weatherhead Company, Cleveland.

Courtesy, The Gasflux Co.

Flux in the Flame

DEVELOPMENT of a new fluxing technique for the use of silver solder and other alloys of low melting points is said to have eliminated many finishing operations that have hitherto been considered necessary steps of procedure. The essence of the improvement is the automatic supply of flux to the flame instead of brushing it by hand on the work or filler rod.

Since failure to use sufficient flux inevitably results in a substandard silver-soldered joint, the natural tendency is to overflux. This results in discoloration and in accumulation of residue which must be removed by a special cleaning operation (usually washing with hot water followed by electrolytic cleaning or pickling) and by grinding and buffing. Furthermore, the gases emanating from the excess of flux may create porous areas that are sufficient to cause rejection of the part in cases where gastight joints are specified.

Studies of large-scale silver-brazing operations in war plants led to the conduction of experiments to develop the automatic vapor-flux process. The advantages of this are said to be: faster production, elimination of discoloration and consequent after cleaning and the elimination of pinholes and porosity.

In this process, the fluxing ingredients are carried in solution in a highly volatile liquid. The solution is in a container that is introduced into the fuel-gas line supplying the torch. The head of the container has a regulating and by-pass valve, and the interior contains a cotton wick or filter that is kept saturated with the liquid. The fuel gas as it passes through the container picks up the flux in vapor form and delivers it to the torch. The flux is thus in the flame, and the proper amount can be secured by adjusting the flux regulating valve.

Presence of the vaporized flux imparts a brilliant green color to the flame. This tends to mask the inner cone, but the flame structure can be readily seen through welding goggles—preferably goggles fitted with green lenses. Final adjustment of the torch should be made to give a mild, brushlike flame.

The above procedure is satisfactory for joints of the butt and fillet types, but lap and press-fit joints (such as the tube within a tube) necessitate a special technique because of the small clearances involved. In these joints, it is not possible to get proper fluxing action by the use of the flame alone, and an auxiliary flux paste must be used. In the tube-within-a-tube type of joint the paste flux should be carefully and lightly applied to the female part of the joint.

» «

94 Million Tons of Steel

In little more than four years, the equivalent of a steel industry four fifths that of the entire British steel industry has been added to American steelmaking capacity. As a result of phenomenal wartime expansion, capacity of this country's steel plants is now rated at 94,054,550 tons of ingot and steel for castings per year.

Blast furnace capacity for producing pig iron and ferro alloys is rated at 68,446,310 tons annually.

A Battery of Pierce-Governed Hobart Gasoline Engine Powered Arc-Welders Helping to Speed the Growth of the Victory Fleet

GOOD WELDING REQUIRED!
. . . Good Governing, Too!

● Constant speed, held to extremely narrow limits, is the responsibility of the governor on an engine-driven arc-welder—to insure unvarying current characteristics.

Pierce Governors, acting on the time-proved flyball principle, are giving sensitive, dependable, instantly responsive regulation. They assure complete current recovery in the shortest space of time after the arc is struck. They often serve with complete freedom from trouble for longer than the engines, themselves.

Pierce Governors are original equipment on many of the most widely used engines. Specify Pierce when you replace your engines. Get full information on the Pierce line through the new Pierce catalog if your units are not now Pierce-equipped.

THE PIERCE GOVERNOR COMPANY, INC.
1607 OHIO AVENUE • ANDERSON, INDIANA
Manufacturers of Pierce Precision Governors and Sisson Automatic Chokes

PIERCE GOVERNORS

TRADE NAMES* OF ELECTRODES AND COMPARABLE AWS-ASTM DESIGNATIONS

Designation	E-4510	E-4511	E-4520	E-6010	E-6011	E-6012	E-6013	E-6020	E-6030	E-7010	E-7020	E-7030
Weld positions	V, F, OH, H	F, V, OH, O	H, Fillet, F	F, V, OH, H	F, V, OH, H	F, V, OH, H	F, V, OH, H	H-Fillet, F	Flat	V, F, OH, H	H-Fillet, F	Flat
General Description	Wire—coating applied before drawing	Wire—light coating after drawing	Wire—coating before drawing	Heavy coated D-C positive	Heavy coated A-C or D-C	Heavy coated D-C negative or A-C	Heavy Coated A-C	H. Coated A-C or neg. for fillets, A-C or pos. flat	Heavy coated D-C pos. or A-C	Heavy Coated D-C pos. only	H. Coated A-C or neg. for fillets A-C or pos. flat	Heavy coated D-C pos. or A-C
Manufacturer												
Air Reduction[1]	41	63 or 44		78E or 79E	230	87 or 187	90 or 90A	81	81 or 83	93	94	
Allis-Chalmers				E-6010	E-6011	E-6012	E-6013	E-6020	E-6030	E-7010	E-7020	E-7030
American Agile				White	Blue	Red-White	Blue-Red	Blue-Grey		Orange	Black-White	
Anthony Carlin[2]	P-170	P-180		PX-50	P-103	P-60 or P-61	P-100	P-70	P-80	Moly-C-Alloy 1 or 2		
Central Steel	Sul 18	Steelkote 18	Speedox D.08	White Flash B	White Flash E				White Flash C	White Flash D		
Champion	Sulcoat	Processed		Blue Devil	Bluedac	Grey Devil	Grey Devil 2	Black Devil	Red Devil Black Devil	Blue Devil 85	Red Devil 75	
Chicago Steel							Ductone AC					
General Electric	L	F, H, M or W-4	W-3	W-22 or W-22H	W-26	W-20 or W-30	W-25	W-24	W-23 or W-24	W-52	W-54	
Harnischfeger	Litecote	Dustcote		AP or AC-1	AC-1	PF, AC-3 or FR	Harcraft or AC-3	DH-2 or FW		CM-50		
Hobart	Sulcoat			55	AC-55	77	AC-77	111		885		111 HT
Hollup	Hollup 30-XL	Hollup 30-S	Hollup 30-XL	Sureweld B	Sureweld C	Sureweld N	Sureweld C	Sureweld F	Sureweld A	Sureweld MLY	Sureweld MLY-A	
Lincoln		Stable-Arc Softweld		Fleetweld 5 Fleetweld 35		Fleetweld 7	Fleetweld 37	Fleetweld 9		Shieldarc 85	Fleetweld GHT	Fleetweld 9 HT
Marquette	Sulcoat	Dustcoat		31-DR or 151	151	151 or 25 ADS	151	33 ADS				
McKay	21	2 or 3		15		17 or 116	116 or 117	16		715	716	
Metal and Thermit				Murex Vertex	Murex Alternex	Murex Genex	Murex Type A	Murex Fillex, Type FHP or F	Type FHP or F	Murex Molex	Murex Type M or Carbon-Moly .50	
Page	B Rust Lime			Hi-Tensile C		Hi-Tensile F or Cr	Hi-Tensile AF					
Reid-Avery[3]	D or Blue Label		D or Blue Label	7	11	8	13	6 or 20	5	74	64	H-D 54
A. O. Smith				SW-10	SW-15	SW-11		SW-35	SW-20	SW-75	SW-73 or 76	
Westinghouse	18 Sulcoat	18 Sulcoat		AP	ACP	FP or SW		DH	DH	AP Moly.	DH Moly.	
Wilson	17 Sulcoat	17 Dipped Coat or 18		98N, 98N V & O	530	107 or 108	520 or 520A	105	851 or 105	Alloy Rod A	Alloy Rod B	

*Trade name or Type No. is usually prefixed by company name.
V = vertical, F = flat, OH = overhead, H = horizontal, H-Fillet = horizontal fillet. [1]Airco prefix. [2]Perfection prefix. [3]Raco prefix.

New Products to Use

Electronic Flame-Cutter

★ A newly designed electronic flame-cutter, entirely automatic in operation, is offered for production shape-cutting. It permits the space on both sides of the machine to be used for cutting, thus

The new Struthers Wells ISC electronic flame-cutter. It is guided by plastic "phonograph" records.

providing greatly increased production. Other advantages claimed by manufacturer are ease of manipulation, no errors, increased cutting speed and the elimination of templates and layouts.

This machine operates on a principle similar to that of the electronic phonograph. It is guided by control records—plastic cylinders which are scribed from record blanks simply by guiding a pointer along the outlines of a full-size or reduced-scale drawing. The scribe marks are inked in, and the records are ready for automatic cutting. The plastic cylinders measure 5¼ in. in diameter by 10¼ in. long. They are not affected by changes in temperature or humidity and can be stored and re-used indefinitely. There is no wear, since the markings are scanned by a beam of light and sensed by a photo-electric system.

A standard machine with 10 ft arms and two torches will simultaneously cut two plates each 120 in. wide, or additional torches can be added and up to 16 narrower pieces cut at one time. The machine is started at one corner of the plate, and it then cuts automatically and continuously, all movement being guided by the records. The operator has only to adjust the torches upon occasion and change the records when operation is to be switched to a different object. Further information may be obtained from manufacturer's Bulletin No. 54-T. **Struthers Wells Corp.**, Titusville, Pa.

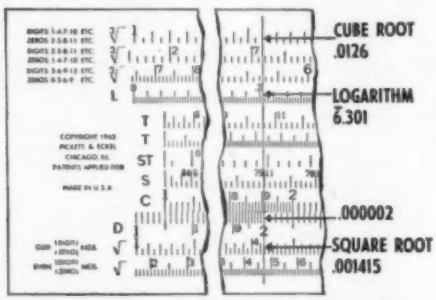
» «

Silver-Brazing Alloy

★ "Nu-Braze" Grade VI silver-brazing alloy is a free-flowing, fast-acting alloy of silver, copper, zinc and cadmium that is fully active at 1,175 F. It corresponds to Navy and Federal Standard specifications for Grade VI alloys and is used to produce high-strength joints in brass, copper, iron, steel, Monel, stainless and other ferrous or non-ferrous metals and alloys. Especially suitable for dissimilar metals, states manufacturer. **Sherman & Co.**, 197 Canal St., New York City 13.

Slide Rule

★ A problem that has perplexed many users of the slide rule has been solved in the "Deci Point" rule recently developed by **Pickett and Eckel**, 53 W. Jackson Blvd., Chicago 4. Ever since the slide rule was invented, some 300 years ago, computers have felt the need for a



By setting the hairline slide of the "Deci Point" slide rule on 0.000002, you can read the square root, cube root or logarithm of this number without change in setting. In determining the square root, pick the square with the odd number of zeros since there are five zeros behind the decimal point. The cube root is likewise located on the scale indicating five zeros. Similarly, the logarithm of the number is written 6.301 to indicate location of the decimal point.

positive, simple, mechanical method of placing the decimal point. Pointing off in powers of 10 presupposes a better knowledge of mathematics than the average person possesses or is able to retain and use with facility after leaving school.

This new device is said to do four things not accomplished by other rules:

(1) The decimal point is determined mechanically in involved expressions, with results up to 19 digits or 19 zeros.

(2) Thirty-inch scale accuracy for cube root and 20-inch scale accuracy for square root are obtained on a rule with 10-inch scales.

(3) With one setting of the hairline, square root, cube root and logarithm of the number can be read; similarly, with one setting of the hair line the number of digits or zeros in the square root or cube root can be determined.

(4) Slide rule calculations are simplified so that persons with a very limited mathematical background can evaluate and point off relatively complicated expressions.

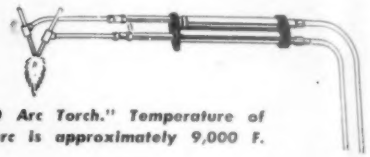
An example showing the use of this rule is given in the accompanying sketch.

BUY WAR BONDS

Arc Torch

★ A new torch to be used in conjunction with arc welders is now being sold under the trade name, "9000 Arc Torch." According to the manufacturer, it provides an "electric flame" of temperature approximately 9,000 F.

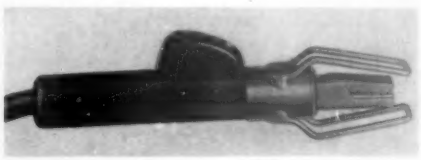
This arc torch can be used with either



"9000 Arc Torch." Temperature of the arc is approximately 9,000 F.

an a-c or a d-c welder for such applications as welding aluminum and its alloys; welding brass, bronze, other copper alloys; welding nickel silver and cast iron. Other applications suggested are: brazing steel, cast iron, malleable iron, copper, brass, bronze, etc.; preheating prior to welding; soldering all ferrous and nonferrous metals; straightening and bending; hard-facing with wear-resistant metals. **Mid-States Equipment Co.**, 2429 S. Michigan Ave., Chicago 16.

» «



Lincoln Type INS electrode holder features light weight, equally good performance on alternating or direct current.

Lincoln Electrode Holder

★ A lightweight, low-cost holder, Type INS, having a current rating of 300 amp is offered by **The Lincoln Electric Co.**, Cleveland. It weighs 22 oz, has ample overload capacity and will handle electrodes ranging from 1/16 to ¼ in. The holder is designed to permit quick electrode changing and to hold the rods securely at any angle.

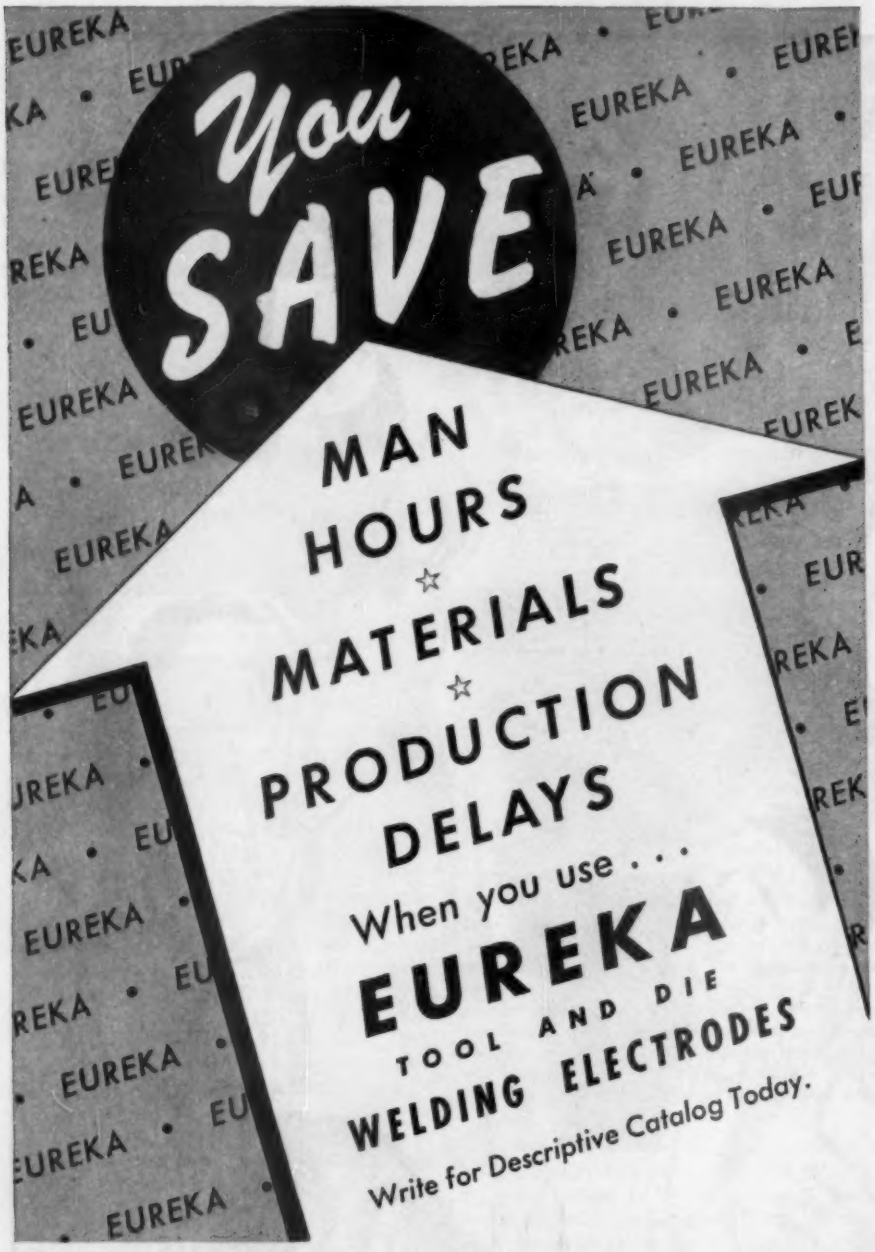
The jaws are made of "Lincalloy," a high-conducting and wear-resisting copper alloy, and are prevented from contacting the work by an insulating guard of spring steel. The trigger is of a molded, heat-resisting inorganic material, and the handle is of fibre and has a hollow space for air cooling.

» «

Face Shields

★ The new "Hundred" series of face shields consists of Models No. 100, 200, 300 and 400, each of which is identified by a variation in headgear design. For each model is offered a choice of three different thicknesses and three different sizes of cellulose-acetate windows and a fibre front for scarfing and welding. **Boyer-Campbell Co.**, 6540 St. Antoine St., Detroit 2.

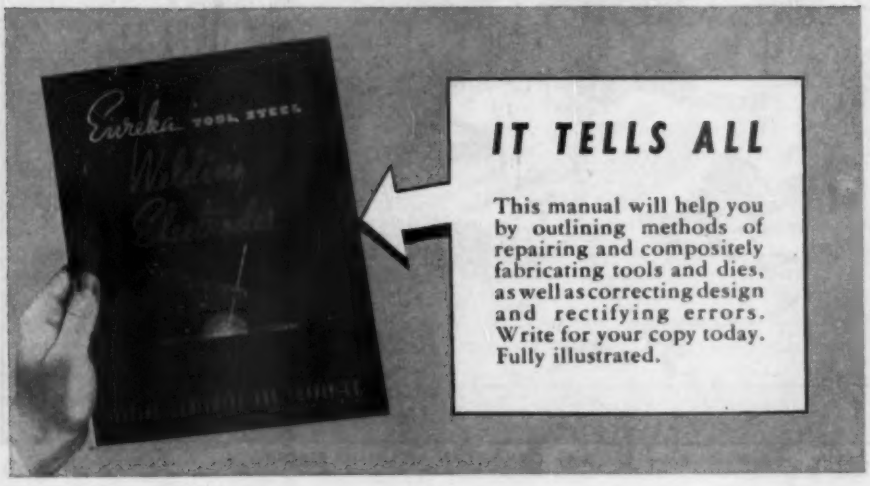
"I know what's the matter, Mom — nobody gave him any CHAMPION WELDING ELECTRODES!"



Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

223 LEIB STREET • FITZROY 3715 • DETROIT 7, MICHIGAN



IT TELLS ALL

This manual will help you by outlining methods of repairing and compositely fabricating tools and dies, as well as correcting design and rectifying errors. Write for your copy today. Fully illustrated.

AO spat. It is made from coated fabric said to give the same protection as rubber against action of acids, alkalis, lubricants and solvents.

Protective Spat

★ Ankle and foot protection against acids, alkalis, oils, solvents and greases is provided by a new AO spat of lightweight coated fabric. Three snap fasteners at the top, two at the bottom make the spat easy to put on and remove. It may be worn under pants or fastened over them, as the wearer prefers. An elastic strap fits under the instep, and a large flare assures overall protection of a large part of the foot. **American Optical Co.**, Southbridge, Mass.

» «

Jackson Face Shield

★ A new featherweight shield, Type J-1, is offered for protection of the eyes and face without narrowing the wearer's angle of vision. The standard visor depth

Jackson Type J-1 shield provides wide, unhampered vision.

is 6 in., but other visors can be supplied in depths of 4 and 8 in. The visor may be either clear or selected from three shades of green: light, medium and dark. It is made of flexible "Plastacele" and can be adjusted to any angle. Snap-on fasteners permit quick removal and replacement of visors.

The shield is fitted to the head by means of a sliding fibre head-strap. A leather sweat band and a fibre spark deflector give added comfort and protection. **Jackson Products,** 3265 Wight St., Detroit 7.

HERE'S THE STORY

★ MAINTENANCE

Repairing a Cast-Iron Valve

Pitting effects of erosion were overcome by combining arc welding and metallizing on a large cast-iron, bronze-seated relief valve.

By GALEN F. BIERY
Seattle City Light Dept.

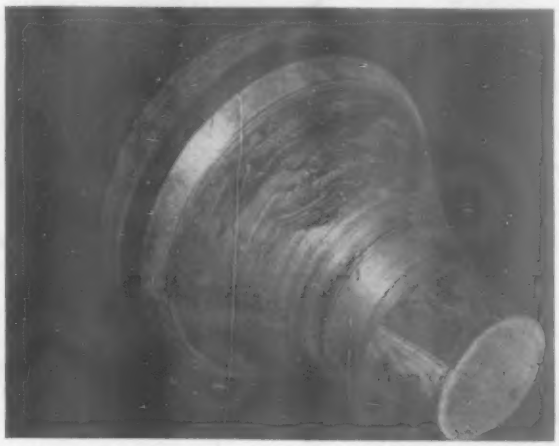


Fig. 1 (left)—This picture was taken just after welding started. Note the many pitted cavities.

THE ACCOMPANYING pictures show two views of a large cast-iron relief valve with a bronze seat. The seat was worn from several years of use, and the cast-iron portion was pitted in irregularly shaped patterns as shown in Fig. 1. In some places these extended to a depth of an inch or more. This type of erosion is common on water wheels, propellers, etc. Engineers are not agreed as to what causes it, but the pitting is known to occur where the water leaves the affected area.

The affected areas were first chipped clean, and an attempt was made to fill the cavities by spraying them with stainless steel. Even though electric bonding was used, this method was not successful as the sprayed metal contracted and pulled loose from the cast iron. The sprayed metal was therefore removed, and the valve put in a lathe so that a small cut could be taken off its entire surface, including both the cast iron and the bronze seat.

We now employed the arc-welding process, using a fabricated rod having a copper core surrounded by an outer sheath of mild steel.

Fig. 1 shows how the weld metal was introduced to fill the cavities. All of the cavities were filled, and a layer of metal deposited to cover the entire surface smoothly. Small beads were laid, and the deposits were peened frequently. This method relieved the strain of contraction and prevented overheating.

After all of the weld metal had been deposited, the valve was placed back in the lathe and turned to just undersize. Next it was sprayed with stainless steel, and the bronze seat was sprayed with bronze. The finished job (Fig. 2) is solid and looks fine, but time alone will be able to tell us the value of the sprayed metal.

Fig. 2 (below)—Finished job. The cast-iron portion was sprayed with stainless steel, and the bronze seat was sprayed with bronze.

THE WELDING ENGINEER—SEPTEMBER, 1944

OUR COPPER ARC ELECTRODE Helped Do a Big Job WELL

The page illustrated from a recent issue of The Welding Engineer shows "before and after" on a big job done with our "Copper Arc" electrodes. The story was interesting to us when we discovered the use of our electrodes and we think it will be of interest to you if you are faced with similar problems.

"Copper Arc" is a general purpose electrode for welding cast iron and copper alloys. It is especially suited for welds which have to withstand shock; for heavy fills which can be finished with "Nico" for machineability and color; and for fills which require surfacing with materials such as stainless steel and bronze.

"Copper Arc" electrodes come in 1/8 inch, 5/32 inch and 3/16 inch sizes. Recommended amperages are as follows: 75 to 150 amps for 1/8 inch electrode; 100 to 200 amps for 5/32 inch electrode; 125 to 250 amp for 3/16 inch electrode. In all cases the lowest possible amperage that will give proper fusion is recommended. "Copper Arc" electrodes are tops as general purpose rods for welding cast iron and copper alloys.

MANUFACTURER OF OTHER SPECIALTIES INCLUDING—

"NICO" The original and most widely used electrode for salvaging and repairing valuable cast iron parts requiring machining.

"BRONZ-ARC" A silicon bronze electrode for welding copper, copper alloys, steel, cast and malleable iron and for joining dissimilar metals.

"ARCAST" A cast iron electrode for preheated cast iron work.

Order from Your Nearest Jobber or Dealer. All Leading Welding Supply Houses Stock Our Line of Electrodes.

Roseau, Minnesota

AMERICAN ARC WELDERS, INC.

HAVE YOU DISCOVERED —

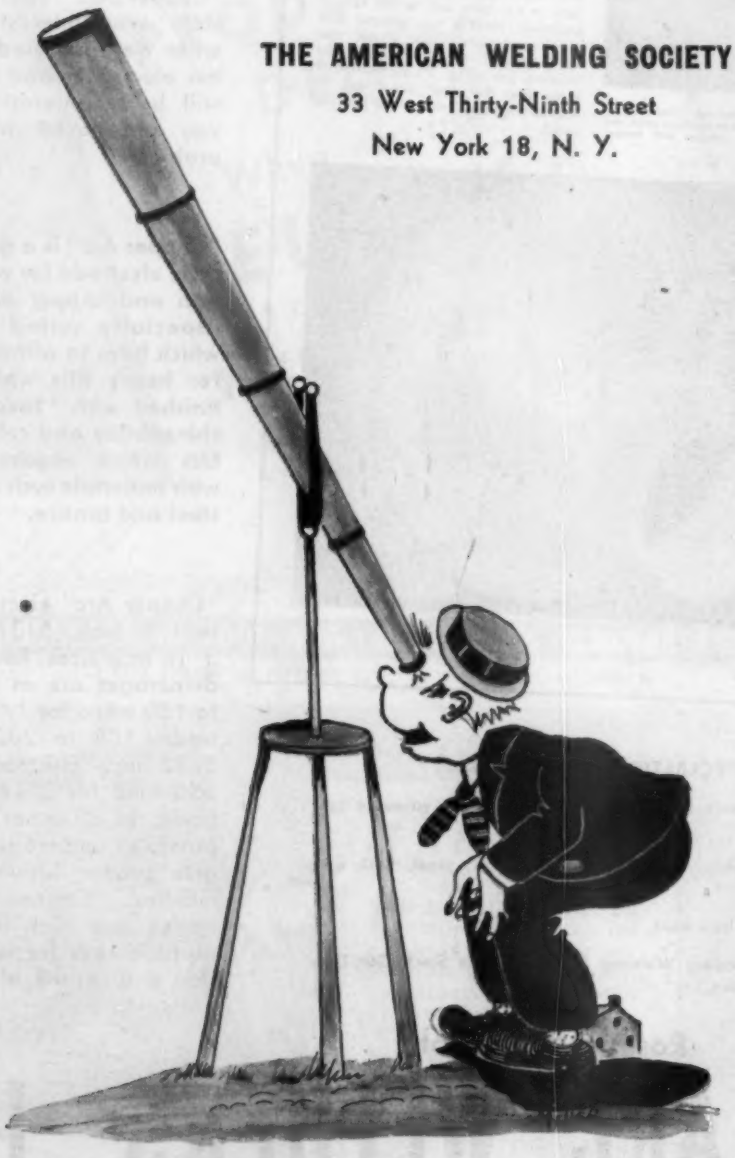
The many advantages that result from membership in the

☆ AMERICAN WELDING SOCIETY

The opportunity is offered to everyone interested in welding. The roster includes leading engineers, production men, contractors, sub-contractors, company officials, research men, students, draftsmen, purchasing agent, foremen. Many government officials are members, also.

Write for booklet

THE AMERICAN WELDING SOCIETY
33 West Thirty-Ninth Street
New York 18, N. Y.



"Shortstub" Holder

★ An electrode holder designed to allow unobstructed visibility while welding and maximum accessibility for deep-pocket work has been announced by the **Hollup Corp.**, a division of the **National Cylinder Gas Co.**, 205 W. Wacker Drive, Chicago 6.

Hollup "Shortstub" holder and a stub length of the shortest possible dimension needed for tight current contact.

This holder was also made to put an end to the necessity for throwing long stub ends—2 to 4 in.—on the scrap pile. With the "Shortstub" holder, company executives state, welding can be done down to a ½ in. stub. An extension of the holder itself allows the formerly unusable stud end to be projected into the proper position for welding while a tight current contact is being made in the holder jaw.

The new holder, its makers say, can be loaded and unloaded in a second and will minimize operator fatigue because of its light weight and balanced construction.

» «

High-Tensile Electrode

★ Type W-55 is a new high-tensile welding electrode for the fabrication of aircraft steels. It is capable of making a deposit of tensile strength comparable to that of the parent metal and was designed especially for use in the manufacture of heavy bombers and transport planes. It can be used for welding in any position, including vertical welding from the top down or from the bottom up. The arc is stable over a reasonably wide voltage range. An arc can be struck at the top of a joint and maintained while welding vertically downward, then overhead, then vertically upward back to the starting point. For these reasons, the new electrode is especially recommended for the welding of engine mounts and fuselage assemblies.

Characterized by a gray extruded coating, the W-55 electrode can be used on either d-c, straight polarity, or on a-c. It is available in $\frac{3}{32}$ in., ⅛ and $\frac{5}{32}$ in. sizes. **Electric Welding Div., General Electric Co.**, Schenectady 5, N. Y.

MECO Equipment Is Producing VITAL WAR MACHINES

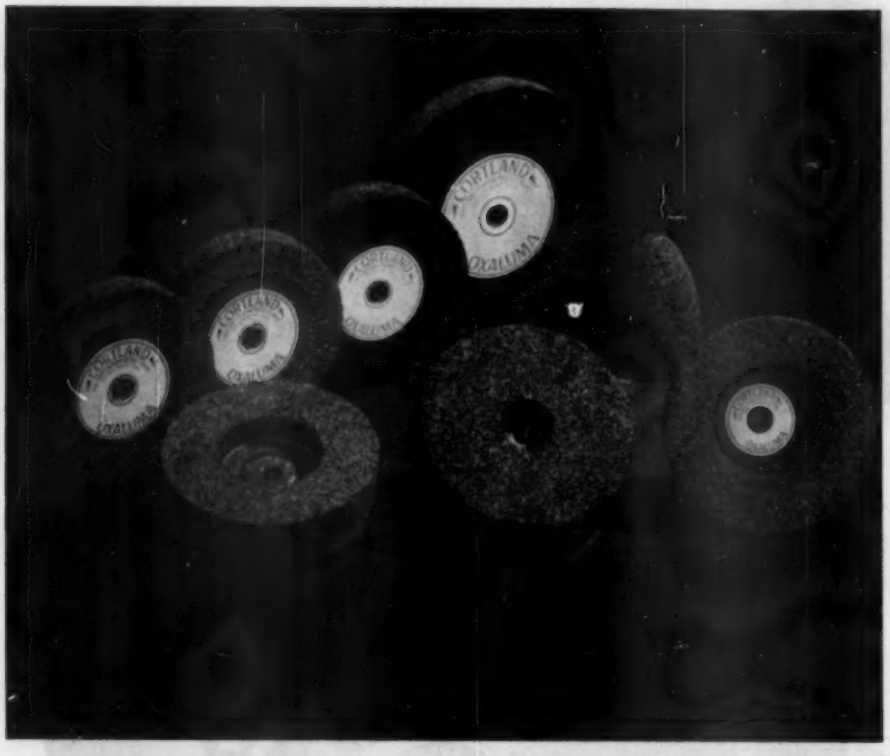
☆ On the Production Front . . . on the Battle Front—Meco oxy-acetylene welding and cutting equipment is speeding the day of Victory. ☆ The reliable operation of Meco Safe-T-Chek Regulators reduce production hazards—saves manhours . . . saves time . . . reduces costs. ☆ If you have been disappointed on deliveries of Meco Equipment, bear in mind that every shipment we make is based on the Victory Cause. Meco Equipment is vital to war production. Oxy-Acetylene Cutting and Welding outfits are standard equipment of all of our armed forces, including the ships at sea.

Meco

Oxy-Acetylene Cutting and Welding Equipment

MODERN ENGINEERING CO.

3413 PINE BOULEVARD ST. LOUIS, MISSOURI



"OLD TIMERS" or "GREEN HANDS" get good results with Cortland Wheels

An experienced weld grinder can tear through the excess metal fast, and produce a surface satin-smooth for polishing, or just rough enough for painting.

Whether your men are "old timers" or "green hands," a Cortland Wheel may improve their output. Because Cortland specializes in wheels for weld grinding and snagging—portable, floor stand and swing frame: Vitrified bonded for operating speeds up to 6,500 S.F.M., and Resinoid bonded for operating speeds up to 9,500 S.F.M.

"Tell us about your operations." We'll recommend the best wheels for cutting costs. Write CORTLAND GRINDING WHEELS CORP., 15 Cortland Street, Chester, Massachusetts.

For better Weld Grinding

CORTLAND

11

Blueprint Cabinets

★ Lyon steel blueprint cabinets, manufacture of which was stopped upon America's entry into the war, are again available for industrial requirements. These cabinets permit fireproof and flat storage of drawings, tracings, blueprints, charts, photographs, etc. Drawers are equipped with hinged paperweights in front and protecting hoods in the rear to insure that the contents will remain flat at all times. Drawers can be divided in many different ways, and several different cabinet sections can be placed one on top of the other. **Lyon Metal Products, Inc.**, Aurora, Ill.

» «

Model R-3-L plate-bending roll. It is offered in 12 different capacities.

Bending Roll

★ A new type of plate-bending roll known as the Model R-3-L is being marketed by the **Webb Corp.**, Webb City, Mo. This machine can be made in 12 capacities to handle plate ranging up to 8 ft of ⅜ in. thickness. Features are an enclosed speed reducer and an automatic balance bar. The machine is equipped with a manually operated raise of the rear roll but can be furnished with a power-operated raise if desired.

» «

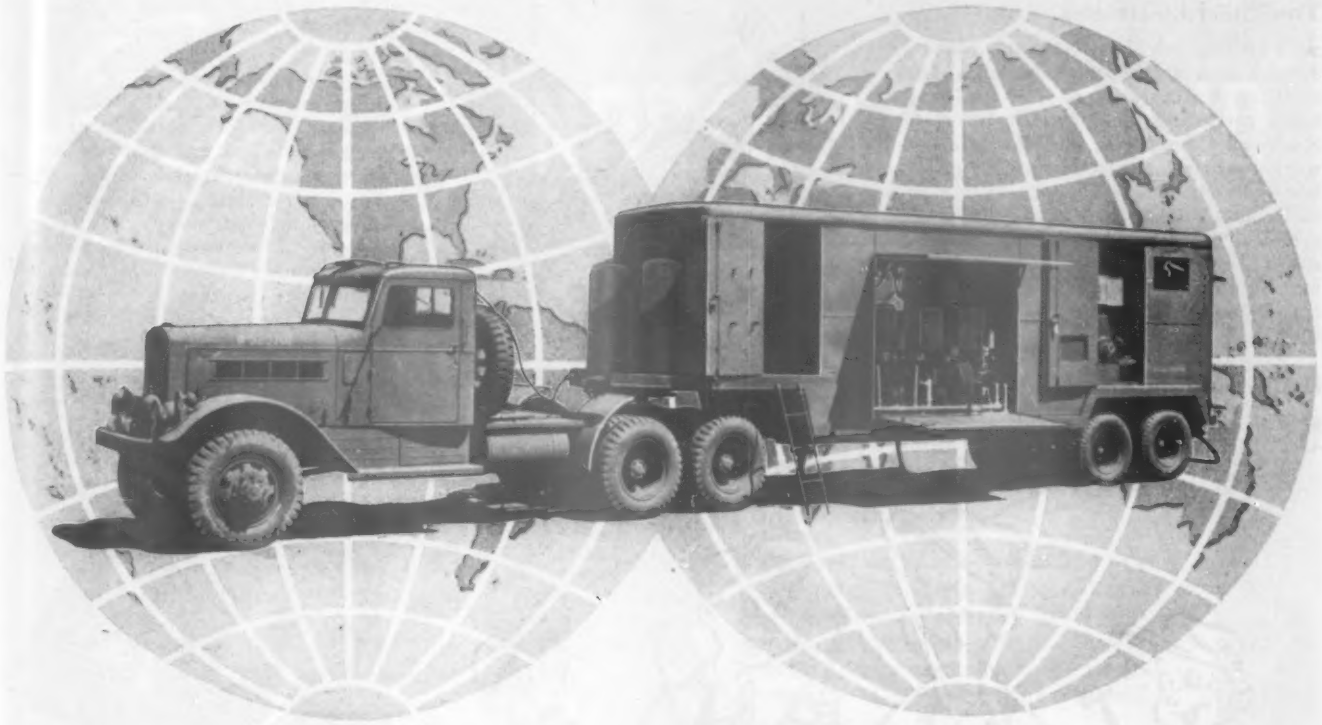
Ground Clamp

★ "E-Z" ground clamp is of solid copper-alloy construction and designed so that the current does not travel a great distance in the clamp, thus preventing overheating. Other features are one-hand operation, mechanical or solder cable connection, large handles and sharp teeth that remove rust or paint and thus insure an efficient ground. **Will-Weld Mfg. Co., Inc.**, 600-620 South 15th St., Omaha 2, Nebr.

» «

Automatic Bench Vise

★ "Vispeed," newest addition to the Bellows line of controlled air-powered devices, consists of a standard 4 in. Reed bench vise that is operated by an 8 in., foot-controlled air cylinder. Clamping pressure is adjustable from zero up to 2½ tons and remains the same operation after operation, thus permitting comparatively fragile materials to be handled without danger of breakage. The vise is foot controlled. **The Bellows Co.**, Akron, O.



Where OXYGEN is Needed

...INDEPENDENT Mobile Oxygen Generators Produce It!

A World-Straddling Supply of Oxygen—*where* it is needed, *when* it is needed . . . produced on the spot by Independent Mobile Oxygen Generators, *Pioneer* Manufacturers of this type of equipment!

Oxygen—For the crews who man our planes—combat, reconnaissance or transport—a vital necessity. Before the plane reaches 10,000 feet, masks must be on and a steady stream of oxygen flowing into them. Flyers cannot function—perform their duties without it. Independent Generators produce oxygen at the flying strip or field.

Oxygen—On the battle-front—for maintenance and repair of mechanized and military equipment—jeeps, tanks, guns . . . oxygen for the cutting and welding torches which are the prime requisite of our fast-moving repair crews. Independent Mobile Generators produce oxygen close to the scene of action.

Oxygen—For the Medical Corps—for treatment in chest injuries, shock, respiratory illness or wherever breathing is affected. Independent Generators supply a steady stream of life-giving . . . life-saving oxygen for these casualties of war.

". . . The White Star, which the renewal adds to your Army-Navy Production Award Flag, is the symbol of appreciation from our Armed Forces for your continued and determined effort and patriotism."

Sincerely yours,

☆ ☆ ☆

In your Post-War Planning—remember that Independent will be able to serve you fully . . . in equipment for producing—transporting and handling of industrial gases.

INDEPENDENT *Engineering* COMPANY, INC.

Manufacturers of MOBILE OXYGEN AND HYDROGEN GENERATORS • BUILDERS OF OXYGEN, HYDROGEN AND ACETYLENE PLANTS • MANUFACTURERS OF INDUSTRIAL GAS CYLINDERS AND CYLINDER HANDLING EQUIPMENT

INVEST IN VICTORY — *Buy* MORE WAR BONDS

O'FALLON, ILLINOIS

Tool-Steel Electrodes

★ Two additions have been made to the Eureka line of tool-steel electrodes. One of these is a moly high-speed-steel electrode producing weld deposits of 60-64 Rockwell C hardness; the other is a hot-work tool-steel electrode producing carbon-moly-chromium deposits having 58-62 Rockwell C hardness. Both electrodes produce "hard-as-welded" deposits, which can be heat treated after welding. **Welding Equipment & Supply Co.**, 223 Leib St., Detroit 7.

» «

Drill-Grinding Attachment

★ This device sharpens drills from No. 42 up to 1½ in. diam, grinds old drills in three different drill-point angles and will grind either long, short or medium twist drills. The attachment is mounted to an emery wheel as shown in the accompanying sketch. Drill trough holder is set in the 59 deg notch on the tilted post for standard grind, in the 69 deg notch for hard materials and in the 88 deg notch for bottom drills or routers. The trough is moved away from the emery for a long twist or moved in for a short twist. **Crandall Mfg. Co.**, 939 West 6th St., Los Angeles 14.

Long, short or medium twist drills can be sharpened at three different angles.

» «

Master Magnifier Set No. 44 provides three models and controls for both flashlight-battery and electric-current operation.

Inspection Magnifiers

★ An assembly of three "Flash-O-Lens" magnifiers in a portable case is offered for inspection work. Each magnifier has a built-in illuminating unit that can be operated by either flashlight battery or 110 volt electric current. The set contains 7X, 20X and 40X magnifiers, the 40-power model being fitted with a 0.001 in. scale.

These magnifiers are used for the observation of minute details that would not be visible to the unaided eye. In the welding field, they can be used for inspecting plating for pitting, pinholes, texture; inspecting metal for incipient cracks; inspecting welds for cracks; detecting incipient corrosion; precision measurements on tools, dies, fixtures, etc. **R. P. Cargille**, 118 Liberty St., New York City 6.

» «

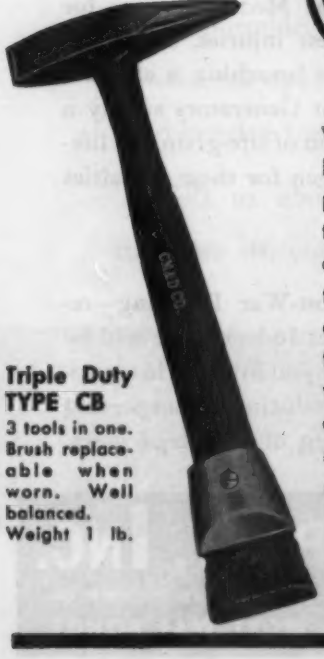
Flux for Cast Iron

★ A flux to promote uniform tinning a cast iron prior to brazing has been developed by the Airco research laboratories. Because of its graphitic nature, the new "Hi-Bond" flux will make possible the successful tinning of cast iron, especially iron of high carbon and silicon content or low combined-carbon analysis. It does not, however, take the place of the flux used for the actual brazing operation, manufacturer states.

The new product may be applied either as a water-mixed paste or sprinkled as a powder on a surface heated to the required temperature. **Air Reduction Sales Co.**, 60 E. 42nd St., New York City 17.

IT'S *Quicker* TO USE A

CMD *Triple-Duty* CHIPPING HAMMER



Triple Duty TYPE CB
3 tools in one. Brush replaceable when worn. Well balanced. Weight 1 lb.

With the Type CB combination drift and chisel hammer, a welder can greatly speed up his output. For he can spend more time welding and less time removing slag—less time laying down tools and picking them up. Without even setting aside the electrode, he can start immediately to chip away the slag. The handy replaceable brush on the handle of this hammer is instantly available when he needs it. For details and prices on this and other popular CMD welders' Chipping Hammers, ask your jobber for latest circular or write direct.

CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

Specify "NORTON RESINOID"

YOU need fast cutting action to quickly remove the excess metal at the weld—you need a smooth surface for the subsequent finishing operations. Norton Grinding Wheels have been scientifically developed in the right grains and grades for all kinds of weld grinding.

STRAIGHT WHEELS—Usually 6" or 8" diameter and from ¼" to 2" thick. For the thinner wheels 20 grain and a coarser grit—24—for the thicker wheels. The most common hardness is P4B or Q4BH Alundum resinoid for carbon and alloy steels.

CUP WHEELS—Probably the most popular sizes are flaring cups (6-4 ½") x 2" x ⅝" with a 1" rim and straight cups 6" x 1 ½" x ⅝" with a 2" rim. They are available with ⅝" holes or mounted on ⅝" threaded steel bushings. For general work, the wheel specification is usually 16 or 20 grit, grade P4B Alundum resinoid.

CONE WHEELS—Cone wheels are mostly used for grinding welds in holes and other hard-to-get-at places. One of the most common sizes is 2 ¾" x3 ½" with ⅝" threaded hole, 24 grit Q4BL Alundum resinoid.

NORTON COMPANY
Worcester 6, Mass.
Distributors in All Principal Cities

W-985

NORTON ABRASIVES

Heating-Element Flux

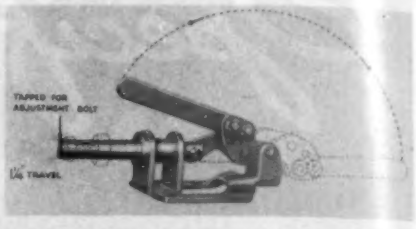
★ Broken or burned-out electrical heating elements can be effectively repaired by means of a new flux developed by the **Chanite Sales Co.**, 914 South Main St., Fort Worth 4, Tex. The flux is applied to the broken element without any tools except a match stick, and the repair is made in a few minutes. The element itself furnishes the resistance supplying the welding heat. The joint is as strong as the original wire, states manufacturer, and any number of joints can be made in a heating element without destroying its utility.

The repair procedure is as follows: (1) the wire is stretched so that its broken ends can be lightly joined or else the gap is bridged with another piece of wire; (2) the wires are moistened with water applied with a match stick or other small piece of wood; (3) the moistened stick is used to apply a small amount of flux to the joint; (4) the ends of the wires are pressed together; (5) the current is turned on. The flux, manufacturer declares, melts almost instantly, and a permanent bond is formed between the ends of the wire.

» «

Toggle Clamp

★ A "push and pull" action features the No. 605 toggle clamp recently added to the De-Sta-Co line. This new 9 oz clamp is especially well suited for locating and indexing, states manufacturer. The work end (plunger rod) is tapped



De-Sta-Co No. 605 "push and pull"-action toggle clamp for locating and indexing.

to receive a threaded bolt, which provides a means of quick adjustment to suit the job at hand. The travel distance of the plunger rod is 1¼ in.

Only a screwdriver is needed to convert the clamp from push to pull action or vice versa. When in "push" locked position, it measures 5½ in. long, 2¼ in. wide, 2$\frac{33}{64}$ in. high; when in "pull" locked position, it is 7$\frac{7}{16}$ in. long, 2¼ in. wide and 2½ in. high. It is finished in a silvery, rust-resisting plating. **Detroit Stamping Co.**, 372 Midland Ave., Detroit 3.

» «

Welding and Brazing Fluxes

★ A line of 20 specialized types of "Superior" fluxes is offered for virtually every welding, brazing and silver-soldering need. These include fluxes for: silver soldering and brazing ferrous and nonferrous metals; gas welding stainless steels; gas welding Inconel and other nickel-chrome-iron alloys; welding aluminum and aluminum alloys; welding magnesium and Dowmetal; brazing cast or malleable iron; brazing copper, brass, bronze and other copper-base alloys; welding Monel; soldering aluminum and die castings; gas welding cast iron with cast-iron rod; brazing with low-melting-point alloys and silver solders; brazing aluminum; welding burnt cast iron with cast-iron rod. Further information can be obtained in manufacturer's Catalog No. 44. **Superior Flux Co.**, 1783 E. 21st St., Cleveland 3.

» «

Hydraulic Bench Press

★ The Reimuller "Hy-Speed" hydraulic bench press can be used as a pipe vise to handle up to 6 in. pipe, as a tensile or compression testing machine up to five tons or as a shear for ¼ in. plate or ½ in. rounds. It is made in one size, five ton, and has a 5 by 6 in. platen with 7 in. of ram movement. The hydraulic foot control uses only two levers: one to apply pressure up to the rated tonnage and the other for release. No outside air-line or power is needed. **Reimuller Brothers Co.**, 9400 Belmont Ave., Franklin Park, Ill.

GRIND DOWN HEAVY BEADS Quicker!
USE SKILSAW PORTABLE GRINDERS!
● SKILSAW PORTABLE GRINDERS deliver top load speed, even when the going is toughest. That's why they grind down heavy beads, studs and fins faster and easier. They're quality-built throughout, with special ball-bearing inserts to absorb vibration and spindle thrust. That's why SKILSAW PORTABLE GRINDERS run cooler, and last longer with less time out for servicing.
You'll save time, money and manpower on all heavy grinding with SKILSAW PORTABLE GRINDERS. Ask your distributor to show you on your own work.
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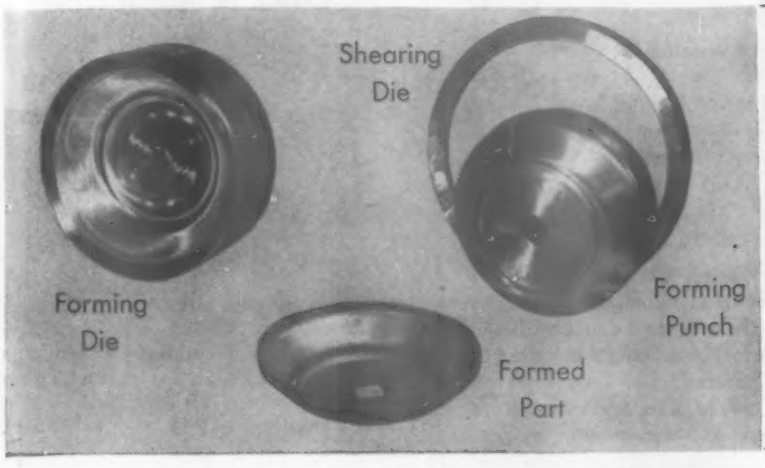
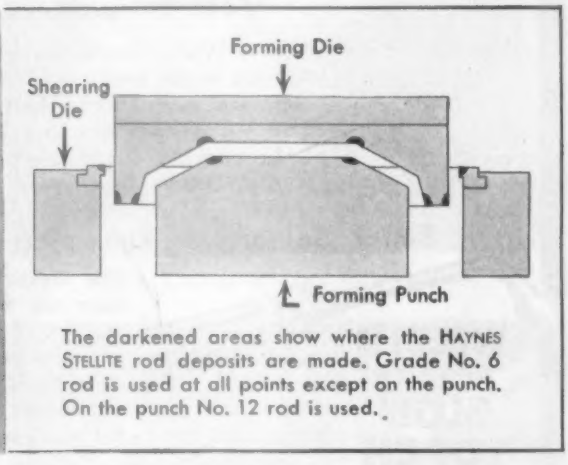
SKILSAW PORTABLE ELECTRIC TOOLS
MAKE AMERICA'S HANDS MORE PRODUCTIVE

BUY WAR BONDS

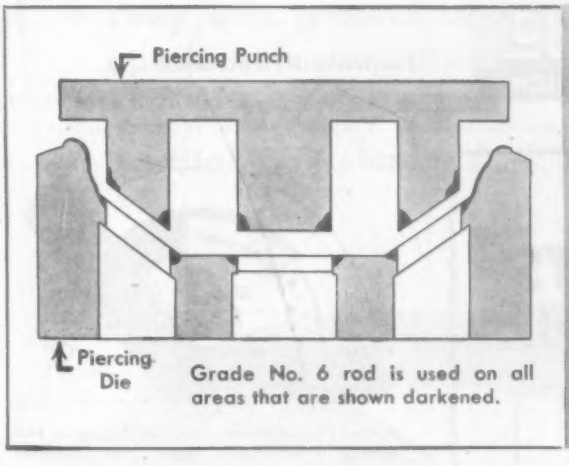
Hard-Facing saves $2,500 on these Truck Wheel Dies

. . . and they last 3 times as long

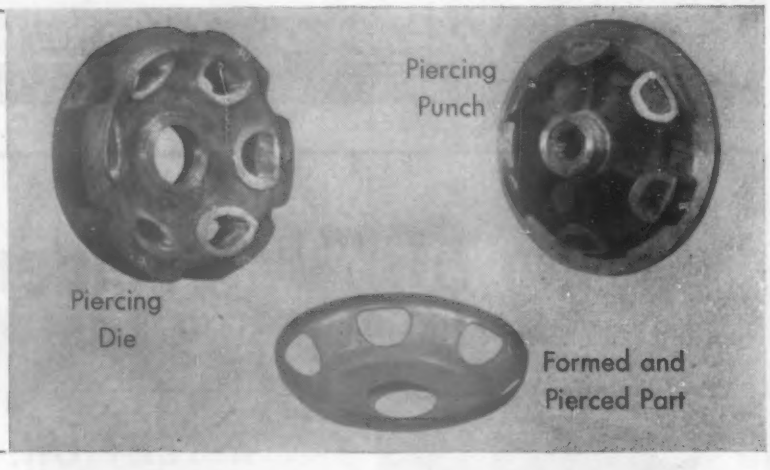




The darkened areas show where the HAYNES STELLITE rod deposits are made. Grade No. 6 rod is used at all points except on the punch. On the punch No. 12 rod is used.



Grade No. 6 rod is used on all areas that are shown darkened.



The old way cost $4,300. Formerly these two sets of dies for making truck wheels were fabricated of special steels. They produced only 15,000 blanks.

The new way costs $1,800. By making these dies of carbon steels and hard-facing working surfaces with HAYNES STELLITE rods a saving of $2,500 is realized in initial costs. In addition, these hard-faced dies turn out 50,000 pieces.

Hard-facing with HAYNES STELLITE rods is an economical way of increasing life in tools, dies, and many other metal parts subjected to extreme wear and abrasion. You can get more information about hard-facing and how to do it by writing for the booklet "Hard-Facing With HAYNES STELLITE Products."

HAYNES STELLITE TRADE-MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York 17, N. Y. UCC Kokomo, Ind.

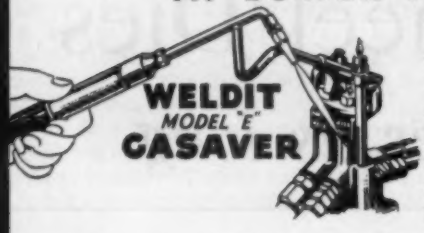
Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.

Safe Welding

AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

WELDIT
MODEL "CW"
BLOW
TORCH

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT ACETYLENE CO.
628 BAGLEY AVENUE • DETROIT 26, MICH.

Larkin SG Arc Welders

HAVE A STARTING CURRENT OF 5 AMPERES

150 SG (5-150 amperes)

ATTENTION:
Industries welding thin metal.

Arc welding thin sheet metal is now EASY. Available 150, 250 and 300 amp. models. Continuous adjustment from 5 amperes to top rating.

(Also built-in power factor correction on Model No. 300 PFSG)

ARC and SPOT WELDERS FOR every welding need.

LARKIN LECTRO PRODUCTS CO., MANUFACTURERS
220 Taaffe Place, BROOKLYN 5, N. Y. • Sales offices throughout the country

Electronic Timer

★ A new electronic timing unit for use in controlling resistance-welding

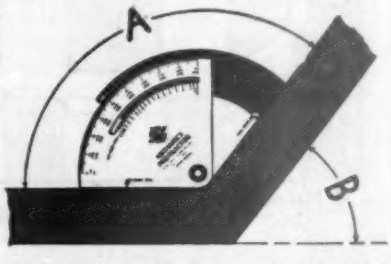
Electronic timer for handling power of from ⅓ to 5 kva.

operations is announced by **Electrical Industries, Inc.**, 42 Summer Ave., Newark 4. A single knob gives instant time control from 1 to 28 cycles in steps of one cycle. This device handles welding power ranging from ½ to 5 kva and is said to be easily applied to either existing or new installations.

» «

Improved Protractor

★ An improved mechanic's protractor of Vinylite plastic is being offered by



Mechanic's protractor. One setting gives both outside ("B") and inside ("A") angles.

the **Interstate Sales Co.**, 1123 Broadway, New York City 10. One setting of the two blades will give readings for: outside angle ("B" in the sketch), inside angle ("A") and inches-per-foot against degrees. The device measures 3¼ by 3¼ in. overall.

» «

High-Voltage D-C Supply

★ New metal-enclosed power supply units provide convenient sources of d-c power for ratings up to 50,000 volts. These units can be used for such applications as induction heating, precipitation, radio, testing electrical equipment and miscellaneous industrial and electronic purposes. Each consists of a full-wave kenotron rectifier, a filter to limit voltage ripple to 1% or less and equipment permitting control of the d-c output voltage from zero to maximum. **General Electric Co.**, Schenectady 5, N. Y.

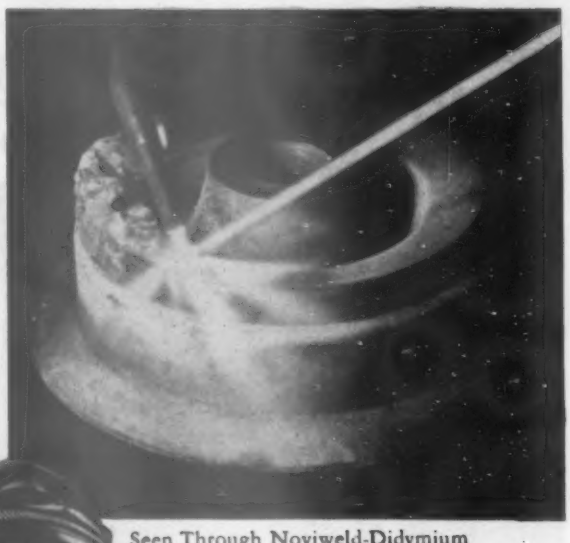
AO NOVIWELD-DIDYMIUM LENSES

Give Your Welders Clearer, Safer Vision

- They screen out sodium flare
- They let the welder see his work in clear, brilliant colors
- They protect against ultra-violet and infra-red radiations
- They are ground and polished to ophthalmic standards

Available in shades 3, 4, 5 and 6

Seen Through Standard Welding Glass



Seen Through Noviweld-Didymium

With a clearer picture of his work, the welder can lay cleaner beads. As a result, secondary operations—chipping, grinding and wire brushing—cost less.

Let an AO Safety Engineer give you a demonstration. Phone or write your nearest AO Branch Office.

AO Duraweld Goggles are available with Noviweld-Didymium lenses

American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

Resistance-Welding Booklet

Written for the non-technician, the 32-page, 8½ by 5¼ in. booklet, "Tomorrow's Production Today by Resistance Welding," tells what resistance welding has accomplished to speed the war effort and what its future possibilities are likely to be because of the lessons learned under the stress of war. The book begins with a brief discussion of the five main categories of resistance welding; namely, spot, projection, seam, flash and upset butt welding. Other chapters tell of the advantages of resistance welding, what it is doing today, what is expected of its future. In addition, a brief history is printed of each of seventeen leading manufacturers in this field. Ask for Bulletin No. 101. **Resistance Welder Manufacturers' Association,** 505 Arch St., Philadelphia 6.

ALLIGATOR SHEAR REPAIRED

with No. 192 Low Fuming Bronze

FACTS for WELDERS... This free booklet contains practical suggestions on the selection and use of Bridgeport Bronze Rods for brazing (bronze welding).

This shear was first repaired by a method which involved considerable time and equipment. An elaborate mold was constructed, covering a wide area surrounding the break, after which the parts were preheated. Then, extremely high temperatures were used during the welding operation. A short time later the shear broke slightly beyond the welded area. ***This time the shear was brazed with Bridgeport's No. 192 low fuming bronze and has been running for many months without sign of failure.***

Brazed parts frequently are stronger than before. No elaborate setup or extensive preheating and slow cooling are required. The base metal needs only to be heated to a cherry red, preventing local brittleness and dangerous stresses. *Switch* to *brazing* with Bridgeport Bronze Welding Rods and accomplish the "impossible" jobs.

Write for free booklet covering the selection of alloys and suggested methods for brazing (bronze welding).

BRIDGEPORT BRASS

"Bridgeport" BRASS

BRIDGEPORT 2, CONN. • ESTABLISHED 1865

BRIDGEPORT BRASS COMPANY

Foreign Welding Words

A "Glossary of Foreign Welding Terms" compiled by M. A. Cordovi research assistant, Welding Research Council of the Engineering Foundation, has been given AWS publication. Four languages are included. Contractors, students and others who may have occasion to consult welding drawings or specifications using German, French, Russian or Spanish terms should find this glossary valuable. Many of the terms for which English definitions or equivalents are given were derived from foreign technical literature and are as yet not to be found in standard or technical dictionaries.

Published as a 20-page, 6 by 9 in. pamphlet, this glossary may be purchased for 50c from the **American Welding Society,** 33 West 39th St., New York City 18.

» «

Stainless-Steel Electrode Book

An informative new book on stainless-steel welding electrodes can be obtained by writing to **Page Steel** and **Wire Division** of American Chain & Cable Co., Inc., Monessen, Pa. In addition to suggestions on how to select the proper electrode for welding stainless steels, this publication includes much helpful information on welding procedures and recommendations.

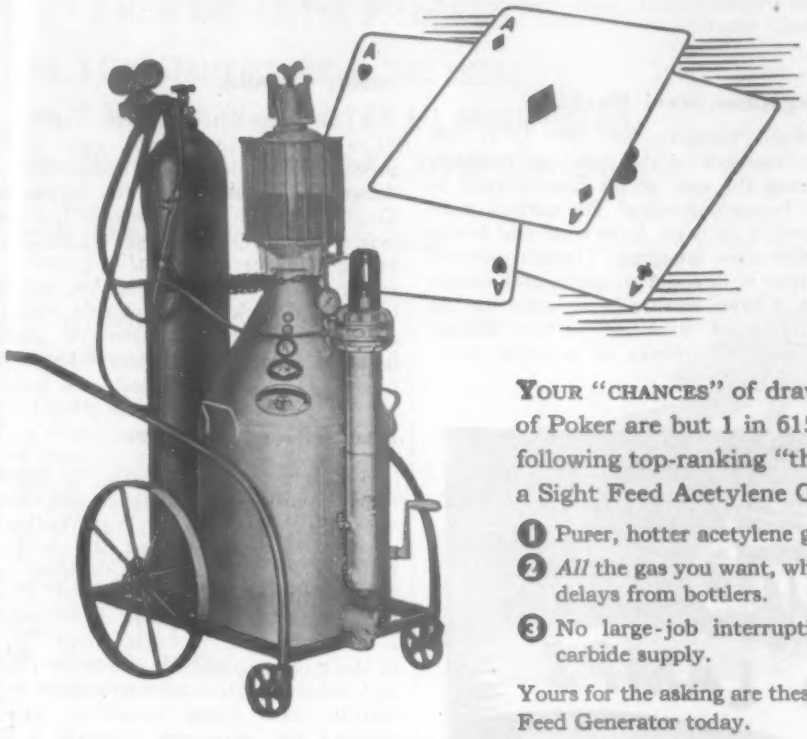
The text is divided into two sections. The first section, devoted to a discussion of general conditions, covers such subjects as carbide precipitation, distortion or warping, effect of heat on the base metal, butt-joint design, preparation of joints, the welding of dissimilar metals. A chart showing recommended electrodes for different types of stainless steels is also included.

The second section gives more detailed information on different types of electrodes, including application recommendations, physical properties and chemical composition of weld metal, current range, size, packing, etc.

» «

"Resistance Welding at Work"

Bulletin WP-44, "Resistance Welding at Work," is a 60-page, two-color, letterhead-size booklet devoted to illustrated examples of various resistance-welding applications. The booklet was designed primarily as a guide to the wide variety of uses to which resistance welding adapts itself—whether it be single spot, multiple spot, seam, flash, butt or projection welding. The material has been arranged under five general headings: (1) portable gun welding (for work assembled in fixtures); (2) stationary spot welding (where work can be brought to the machine), single and multiple; (3) seam welding, either in machines or in fixtures; (4) special uses and machines; (5) fixtures. The latter section includes all general types of fixtures—stationary, turntable, tilting—for parts a few inches in size to 85 ft long. **Progressive Welder Co.,** 3050 E. Outer Drive, Detroit 12.



One in 615

YOUR "CHANCES" of drawing three aces in a friendly hand of Poker are but 1 in 615. But you're a cinch to draw the following top-ranking "three of a kind" when you purchase a Sight Feed Acetylene Generator:

1. Purer, hotter acetylene gas *at savings up to 75%*.
2. *All* the gas you want, where and when you want it. No delivery delays from bottlers.
3. No large-job interruptions, thanks to Sight Feed's *visible* carbide supply.

Yours for the asking are these "three aces"... just order your Sight Feed Generator today.

THE *Sight Feed* GENERATOR COMPANY • SALES: RICHMOND, IND. • FACTORY: W. ALEXANDRIA, O.

Save Time While Reloading!

Automatic Welding-head Positioner — adaptable to your own holding fixture.

WRITE
for information relating to your particular welding fixture problem

How TO SPEED UP WELDING OPERATIONS!

Use This Dual Automatic Welding Fixture!

THIS Acme dual fixture arrangement permits practically constant use of an automatic welding head, because one of the fixtures can be reloaded while the other is engaged in the welding operation.

The holding machine can be set to revolve at any angle from vertical to horizontal. (Illustration shows a wheel being welded at 45° angle.) Positioner arm swings from one fixture to the other, locking in proper position. Speed of rotating the work is adjustable, as desired.

ACME *Manufacturing Co.*
1642 HOWARD ST. • DETROIT, MICH.

Piping for Food Processing

Food processing, America's Number One industry, is the subject of the entire issue of Vol. 3, No. 4 "Sparks," quarterly house organ of **Tube Turns, Inc.,** Louisville 1. The 12-page, 10 by 14 in. publication is largely devoted to the piping needed by food processors for steam, water, refrigeration, mixing, separating, cleaning, packaging, etc. A schematic diagram of equipment and material flow in a representative plant for the manufacture of corn syrup is reproduced as graphic evidence of the major role piping plays in food processing.

Forged, seamless welding fittings, it is pointed out, will strengthen piping systems and provide protection against leaks, replacements and maintenance delays.

» «

Manganese Steel Booklet

Amsco Bulletin No. 844 D is the latest member of the series of booklets covering the uses of manganese steel in basic heavy industries. The current publication, a 56-page, letterhead-size booklet, discusses dredging. Though most of the text is devoted to parts and equipment, a brief section is included on the rebuilding of worn or broken dredge equipment by means of welding products. **American Manganese Steel Division** of American Brake Shoe Co., Chicago Heights, Ill.

» «

Safety Catalog

A 20-page, letterhead-size catalog of "Eye Gard" and "Body Gard" safety products has just been published by **American Industrial Safety Equipment Co.,** 397 Bridge St., Brooklyn 1, a division of The Burdett Oxygen Co., Cleveland. This catalog, No. 101, covers a comprehensive line of goggles, welding lenses, spectacles, face shields, respirators, rubber gloves, asbestos gloves, helmets, hand shields and related items.

» «

Booklet on War Films

An eight-page, 4 by 8½ in. booklet issued jointly by the Army and Navy, entitled "War Films for War Workers," is devoted to illustrating the methods being successfully used in showing special battle-front films in war plants throughout the country. Photographs are reproduced of exhibitions given in stock rooms, cafeterias, meeting rooms and other facilities of war plants to illustrate how these locations can be adapted for showings through a few simple devices. Also included are suggestions for utilizing local theatres, parks, union halls and outdoor spaces. Copies of the booklet may be obtained by writing to the Chief of the **Industrial Incentive Division,** Navy Dept., 2118 Massachusetts Avenue, Washington 25, D. C.

» «

Electrode Folder

A 16-page, 3½ by 7 in. folder on arc-welding electrodes, Bulletin L6348, has been released by **Allis-Chalmers Mfg. Co.,** Milwaukee 1. The bulletin gives a complete description of each electrode in the Allis-Chalmers line, both a-c and d-c types, and also reproduces tables giving the physical properties of weld metal and recommended current values for each electrode. The electrodes making up this new line are identified by official AWS classification numbers.

» «

Guide to Federal Agencies

"Federal Agencies," Publication No. 333 of the Citizens National Committee, comes close to being a businessman's guidebook of the Capital's bureaus. This 72-page, 5½ by 8½ in. publication gives a descriptive tabulation of 428 functional units of the Federal government—Executive (374), Legislative (6), Judicial (3) and Corporate (61). Under each organization is listed its full name, function, year of creation, appropriation and number of employees. An eight-page cross-index lists the agencies alphabetically, both by their official names and by the key word in each name as well. A copy of this handbook may be obtained for 25c from the **Citizens National Committee, Inc.,** 1409 L Street, N. W., Washington 5, D. C.

Withstand Hot Spatter and Rough Handling

Here is a lamp for welders that stands up under the most gruelling service. Radiant Spatterproof Lamps are built of special glass to resist hot metal spatter and rough handling to a degree never before achieved. Radiant Spatterproof Lamps increase production by reducing delays due to lamp replacement. A trial order will prove the economy of Radiant Spatterproof Lamps. Available in 50, 75, 100, and 150 W sizes.

PROOF

Lower lamp still burns despite severe service.

RADIANT LAMP CORPORATION

Lamps from 50 to 10,000 watts

300 Jelliff Avenue Newark 8, N. J.

TRI-FLUX

A NEW AND BETTER SOLDERING FLUX

No. 5 FOR STAINLESS AND MONEL METAL

No. 3 TRI-FLUX (Regular) FOR ALL OTHER METALS

No. 20 TRI-FLUX (Neutral) NO AFTER CORROSION

ONE APPLICATION { CLEANS / REMOVES RUST / FLUXES

TRI-FLUX is amazing in its simplicity, efficiently performs three distinct jobs and is extremely economical. Saves time and money—no waste. Truly the most etching flux ever developed. TRI-FLUX cleans, removes rust and fluxes all in one operation. TRI-FLUX made in single strength for steel, iron and other metal surfaces. TRI-FLUX No. 5 especially designed for stainless steel and monel metals.

Tri-Flux Advantages

- No need to pre-clean with acid, or oil solvent
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- May be used for hand or torch soldering
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- No disagreeable odors

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SHEBOYGAN • **WISCONSIN**

C-F POSITIONERS

In any Welding Operation It's "Position" that Counts

Production welding usually means working on top, bottom and on all sides of the weldment. It means a "quick change" of position should be possible for greater time saving, more efficiency, lower costs and greater safety to men and materials. With C-F positioners a welder can quickly position even the most cumbersome weldments at the press of a button, without crane help or handling crews. With just one set-up of the weldment, he can position it easily, speedily and safely, all alone. He can rotate it a full 360° at variable speeds from 0 R.P.M. up, tilt it to 135° beyond horizontal, and can weld, downhand, all sides, surfaces and angles in the one set-up with larger rods and fewer passes. All C-F positioners, both stationary and portable, are pedestal mounted to give maximum floor and working clearance and all are adjustable for height.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO.

1309 S. Kilbourn Ave. **Chicago 23, Ill.**

Cable-Splicing Information

"Punch-Lok Streamlined Method of Banding and Splicing" is the title of a six-page, letterhead-size bulletin, No. 108, outlining the electrical applications of this method of making flexible cable line taps, solid wire line taps, clamping guy wire guards and anchors, splicing welding cable, repairing splits in crossarms, ladders, etc. **Punch-Lok Co.**, 321 North Justine St., Chicago 7.

» «

Hydraulic-Lifting Data

Lyon-Raymond Bulletin No. 137, a four-page, letterhead-size folder, is devoted to hydraulic devices engineered and developed for specific applications. Pictured and described are custom-built hydraulic presses, a hydraulic elevating, roller-top table, a tiering truck, an automatic, high-elevating turntable and other products. **Lyon-Raymond Corp.**, 1897 Madison St., Greene, N. Y.

» «

Belt-Grinding Booklets

Four new publications illustrating and describing the "3-M" method of grinding and finishing are available upon request to **Minnesota Mining and Mfg. Co.**, 900 Fauquier Ave., St. Paul 6, Minn. The largest booklet in the series, a 12-page, letterhead-size publication entitled "Step Up Production," gives a detailed explanation of the uses of abrasive backstand belts, segment face contact wheels with backstand idlers, swing grinders and other similar equipment. Technical data and reproductions of "action" photographs of equipment in service are also included.

The three smaller booklets, each 12 pages, 6¼ by 3¼ in., deal individually with the grinding and finishing of small parts and tools, heavy-duty grinding and finishing of flat or curved surfaces, and the employment of a semiportable unit for cutting down large welded areas or grinding and conditioning raw metal stock—armor plate, billets, sheets and tubes.

» «

P&H Products

Bulletin G2-2, a 16-page, 4 by 8¼ in. pamphlet, illustrates and describes P&H overhead traveling cranes, electric hoists, electric motors, welding positioners, welding control units, crawler cranes, truck cranes, excavators, gas, Diesel and electric shovels. Arc welders and welding electrodes are also included. **Harnischfeger Corp.**, 4400 W. National Ave., Milwaukee 14.

» «

"Grinding Facts"

The above is the title of a 136-page reference book on grinding prepared by **The Carborundum Co.**, Niagara Falls, to acquaint users with the newly announced standard markings for the identification of grinding wheels and other bonded abrasives. In addition to the explanation of the new marking symbols, a description of each common type of grinding operation and a schedule of grading recommendations are also included.

» «

Silver-Brazing Bulletin

Helpful hints on the preplacement of "Sil-Fos" and "Easy-Flo" silver-brazing alloys are given in "Low-Temperature Brazing News No. 29," a four-page, letterhead-size bulletin published by **Handy & Harman**, 82 Fulton St., New York City 7.

» «

Heat-Treatment Folder

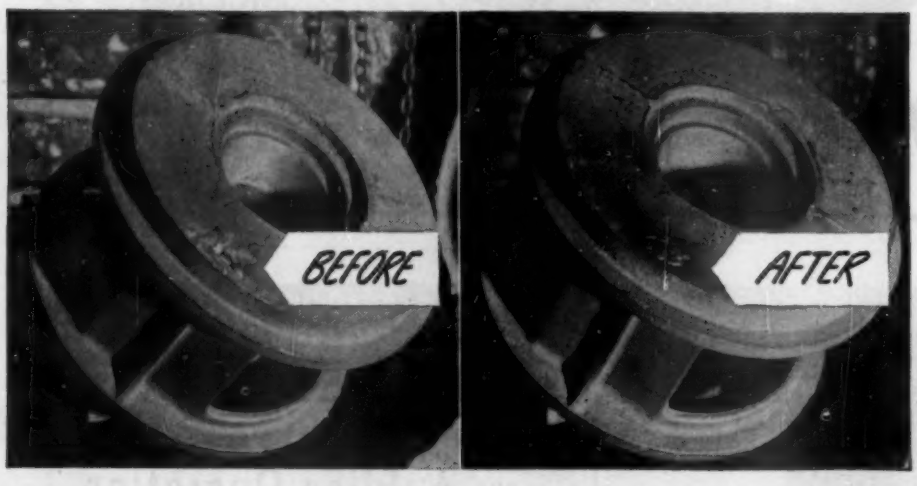
A four-page, letterhead-size bulletin on "flow" heat treatment gives the steps, baths, temperatures, times and equipment used for this process. There is also technical information as to the physical properties obtainable. **The A. F. Holden Co.**, New Haven 8, Conn.

» «

Ventilation Catalog

Bulletin A-200, a 24-page, letterhead-size catalog, describes a line of individual dust collectors for the removal of dust from various sizes of surface, tool, pedestal, etc. disc grinders and sanders. **Aget-Detroit Co.**, 602 First National Bldg., Ann Arbor, Mich.

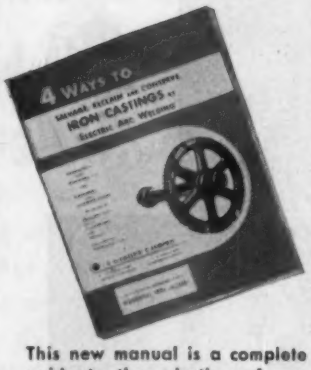
YOU CAN MACHINE IT OR DRILL IT ANY WAY YOU LIKE



THE foundry welder knows. Foundries have been using PHILLIPS "600" Electrode for salvaging gray iron castings for years. One good reason why PHILLIPS "600" is the preferred rod for foundry salvage work is that the deposit is completely machinable *even through the line of fusion.*

Further PHILLIPS "600" deposits are as strong as cast iron and of the same color. Thus, with a very little material and a very few minutes of welding time, castings with small defects are restored, and at only a trifling cost per casting.

C. E. Phillips and Company carry in stock a complete line of electrodes for salvaging and repairing iron castings. To help you to select the correct electrode for each type of application, and the best procedure for using each electrode, we have prepared the manual of arc welding procedures for cast iron illustrated here. To get the best results on every job it is essential that you follow these practices which have been proved by long experience.



This new manual is a complete guide to the selection of materials and procedures for arc welding cast iron. Send for your copy TODAY.

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MANUFACTURERS AND DISTRIBUTORS OF WELDING ELECTRODES AND SPECIALTIES

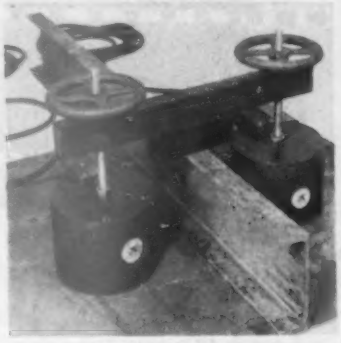
ALIGNING BUTT END PLATES
FOR TACK WELDING

HERCULES ALIGNER is placed squarely on the seam and when energized instantly draws both plates flush against the perfect surface of the magnet thereby trueing up areas on both sides for tacking. Operation is quick, simple and foolproof. Magnetic pull is so tremendous that men can walk or work nearby without disturbing alignment. Units work in all positions (vertical, overhead, etc.).

Welders, Ship Fitters, Plate Fabricators!
FOR QUICK, PERFECT ALIGNMENT OF STEEL PLATES . . . FOR INCREASED PRODUCTION . . . FOR ELIMINATING WARPING . . .

HERCULES MAGNETIC ALIGNERS

Heavy butt end plates instantly aligned. Warped ¼" plates quickly positioned for welding to reinforced stiffener beams . . . pressures up to 4000 pounds! Units easily handled (weight 80 lbs.) No more welding on temporary clamps . . . No grinding, wedging . . . No using heavy weights.



BUCKLING ELIMINATED
BY PRESSURING STIFFENER BEAM

Shipbuilding requires reinforced stiffener beams welded across each plate at stated intervals. Warped plates are quickly positioned for welding to the stiffener beam by placing the aligners as pictured. When current is on, ALIGNERS grip the plate and by turning the wheels 4000 lbs. pressure can be applied through the crossbar to the stiffener beam and plate, causing powerful adhesion and perfect unwarped fit.

HERCULES ELECTRIC & MFG. CO. INC.

MANUFACTURERS OF THE PRECISION WELDER WITH THE
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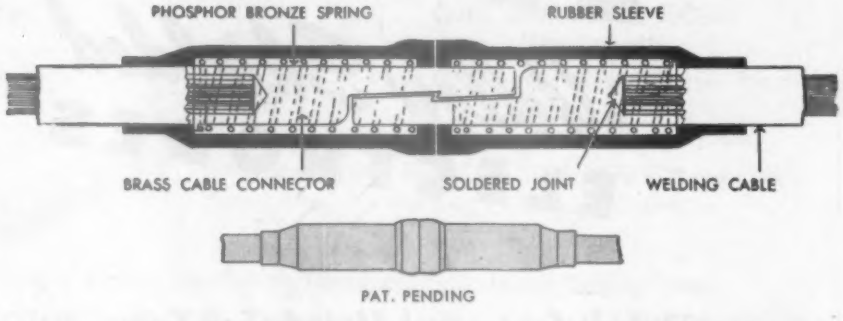
TUFFLINE
UNIVERSAL
WELDING CONNECTOR

SECTIONAL VIEW



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SMOOTH FAST ACTION!

- Just push them together and . . . click . . . a firm electrical connection!
- To disconnect . . . just pull them apart!

No opposite member to hunt for . . . both ends alike. No loose connections . . . they LOCK. Solid brass connectors . . . will not crush. Connectors completely insulated, whether joined or separated.

CARRYING CAPACITY GREATER THAN THAT OF 2/0 WELDING CABLE

See this efficient connector in action. Write for further details and request our representative to demonstrate it on your job.

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News of the Industry

Electron Microscope Reveals Secrets of Metal Structure

The point of a common pin appears as vast and rough as a mountain range when photographed through an electron microscope and enlarged to 100,000 diameters on a three-dimensional Polaroid vectograph, members of the Optical Society of America learned at their recent 29th annual meeting.

Three-dimensional pictures of views through an electron microscope, revealing the shape of the ultramicroscopic crystals of which magnesium and other metals are composed, were demonstrated publicly for the first time at this meeting. The demonstration was made by Robert D. Heidenreich, of the Dow Chemical Co., Midland, Mich., which has been using the electron microscope in the investigation of corrosion phenomena in magnesium alloys.

"The combination of the electron microscope and the Polaroid vectograph process (three-dimensional pictures) offers metallurgists a peephole into the microscosmos," Heidenreich declared. "We can now examine the shape of microstructures just as readily as one can examine the formation of rock in a quarry."

» «

Plan Terminals for Ocean Air-Leviathans

Radical new designs for high-traffic flying-boat terminals for large cities were released last month by Glenn L. Martin, president of The Glenn L. Martin Co., Baltimore, the company which a decade ago introduced the first transoceanic commercial aircraft, the China Clipper.

As an integral part of the plans, Mr. Martin exhibited the design for a unique horseshoe-shaped tug for the handling of the flying vessels in congested harbor waters and in docking. The terminals themselves would be relatively inexpensive and would require only a modest strip of harbor shoreline for the terminal building and service hangars.

One design is in the shape of a pier with floating tidal docks for the loading and unloading of passengers, mail and cargo. The tug would be used to dock the winged leviathans in these slips and would then proceed *under* the pier to another assignment.

Another design, admittedly more costly, is a large circular affair built offshore in the harbor and connected by a tunnel with the land. The terminal building would be in the center and the tidal slips ranged around the perimeter of the circle. Still another design would be built along the shoreline and employ a system of high-speed cable handling for the beaching and launching of the vessels.

» «

Gas Ass'n. to Meet New York, Jan. 22

The thirty-second annual meeting and wartime conference of the Compressed Gas Manufacturers' Association, Inc., will be held at the Waldorf-Astoria, New York City, on January 22 and 23, 1945. The first day will be devoted to committee meetings, a luncheon and the annual business meeting; the second day entirely to a technical session.

Members planning to attend are advised by the Waldorf-Astoria to make their reservations as soon as possible, owing to the unprecedented demand for rooms.

» «

Five Years of Engineering Made Compulsory at Cornell

Cornell University will require five years after the war instead of the conventional four years for a bachelor's degree in all branches of engineering. The reason, states the University, is that various studies made by those interested in the engineering profession have always indicated the need for broader training. The five-year curricula will require 180 credit hours, of which not less than 125 can be given to scientific and technical courses. The remaining credits must be obtained from managerial and non-technical courses, which will be arranged to run parallel with the technical studies over the five-year period.

The Best Phosphor Bronze Electrodes You Can Use

EDCO

Yellow Shielded

ELECTRODES

18-Inch Center and 14-Inch End Grip

● You can't select a better phosphor bronze electrode than EDCO YELLOW SHIELDED . . . the rod that is used and endorsed by railroads, shipyards, refineries, aircraft and many others. EDCO YELLOW SHIELDED ELECTRODES may be specified for all types of electric bronze welding with complete confidence. They are manufactured exclusively by EDCO.

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ECCLES & DAVIES MACHINERY CO.

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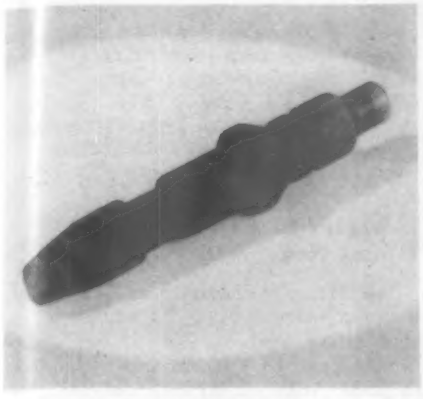


Before

INTRODUCING TIP CLEEN

A NEW MAGIC CLEANER FOR WELDING TORCH TIPS

Due to the extreme heat of the torch, impurities and deposits settle in the nozzle and in time clog it up.

Tip Cleen Removes these deposits Easily . . . WITHOUT HARM TO THE TIPS.

Tips already thrown into the discard because their clogged condition made cleaning seem impossible Have Been Cleaned Easily With Tip Cleen.

Just Think Of The Economy . . . Not Only In The Number Of Tips Saved But Also In Labor And Delays!

Save——Time——And——Money

After

New, Simple, Easy . . . No Harm to Tips

Old methods frequently used Strong and Injurious Acids . . . Tip Cleen Is absolutely Non-injurious to the tips. Drills have been used, but they injure the passages by breaking off and by changing the tapered tolerances.

To clean Tips by this new method, merely heat Tip Cleen to 150 degrees Fahrenheit, drop in tips for four hours, remove tips and rinse in cold water. THEY WILL BE AS CLEAN AS NEW . . . No impurities will remain in the air passages . . . it will shine like a new rifle barrel.

Be Convinced At No Cost To Yourself . . . Send For A Free Sample Today.
Weight approximately 50 lbs. per shipping case. Packed in gallon containers 4 to the shipping case.

SHEBOYGAN **WOLFE-KOTE CO.** WISCONSIN

Makers of CORE CLEEN, CARBON CLEEN, GREASE CLEEN

W-AL-CO RODS for Welding of ALUMINUM

ARC WELDING ELECTRODES

(Flux-Coated)

Type E-43—5% Silicon-Drawn Aluminum

Type E-2S—Pure Drawn Aluminum

***Types E-142, E-195, E-355 and E-356**—Aluminum Alloy for welding CAST ALUMINUM

Send for descriptive circular.

GAS WELDING RODS

(Flux-Coated)

Type G-43—5% Silicon-Drawn Aluminum

Type G-2S—Pure Drawn Aluminum

***Types G-142, G-195, G-355 and G-356**—Aluminum Alloy for welding CAST ALUMINUM

**Available in 1/16" size only*

Assure dense, ductile, strong welds. Ease of Control; Free-Flowing Characteristics; Increased Welding Speeds.

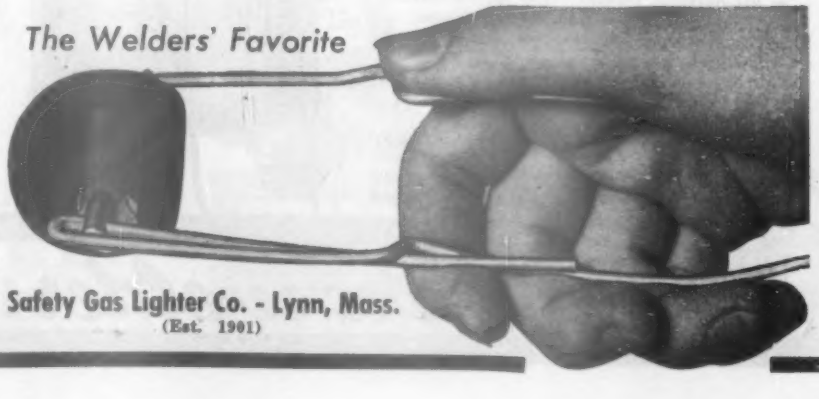
WELDING ALLOYS MANUFACTURING CO. 744 Broad St., NEWARK 2, N. J.

The Improved "Round File" Gas Lighter

Many superior design and construction features combine to make the Improved "Round File" the most efficient and economical torch lighter.
An unusually large file area (approx. one sq. inch) is provided. The file is of superior quality, hardened in our factory. Spark metal is of large diameter and the patented cartridge holding the metal locks exactly into position, permitting instant replacement.
Send for descriptive folders and prices.

This renewal box is handy, saves time. Contains six Renewals. (Renewals also supplied singly—in individual glassine envelope.)

The Welders' Favorite



Safety Gas Lighter Co. - Lynn, Mass.
(Est. 1901)

Southern Oxygen Co., Inc. Expands for War Effort

At the beginning of the second World War, the plant of the Southern Oxygen Co., Inc., was a compact, rather crowded unit located on ground adjacent to the present Pentagon building, Washington, D. C. Late in 1941 the Government served notice of condemnation and by July, 1942, the company was forced to move to its present location at 2900 Kenilworth Ave., Bladensburg, Md. Though just as near to the trading center of Washington as formerly, the company now has 24 acres of ground for a modern plant and office building of substantially increased capacity.

In addition to the production of oxygen, hydrogen and other gases, Southern Oxygen has aided the war effort by manufacturing acetylene cylinders, badly needed by the Army and Navy. Other war activities have included the design and assembly of special types of portable welding and cutting outfits, extra light individual cutting outfits known as "piggy-back" units, electrode holders and other equipment.

» «

Dresser Industries Moved to Cleveland

Dresser Industries, Inc., large manufacturer of equipment for the oil, gas and industrial fields, has moved its headquarters from Bradford, Pa., to the Terminal Tower, Cleveland. The recent acquisition of the International-Stacey Corp. and subsidiaries brings the members of the Dresser group to ten companies, manufacturing a line of related products ranging from pipe couplings to large pumps, blowers and compressors.

» «

Hercules Electric Opens New Factory

The Hercules Electric and Mfg. Corp., manufacturer of d-c and a-c arc welders, spot welders and other electrical products, is now located in its new plant and offices at 2500 Atlantic Ave., Brooklyn 7. Expanded facilities, states the management, now enable the company to give improved service to its customers.

You get versatility

With MARQUETTE A. C. ARC WELDERS

Big jobs or little jobs . . . on cast iron, malleable castings, aluminum and practically every weldable metal . . . hardsurfacing and the heavy cutting of cast iron . . . MARQUETTE takes them all in its stride, delivering the same fast, low cost, flawless performance that it does on the ordinary welding of light sheet metal or heavy steel structures.

That's one of the reasons why MARQUETTE Welders will cut your metal fabrication or repair costs and make for you BIGGER welding profits.

Buy the Best . . . Buy Marquette

LOW INITIAL COST — LOW COST OPERATION —NEGLIGIBLE UPKEEP—NO "MAGNETIC BLOW" — ALL ASBESTOS INSULATION — INSTANTANEOUS HEAT SELECTION — COMPLETE EQUIPMENT — SUPERB ARC PERFORMANCE
10 Models, 125 to 400 amps.

Send for free, 24 page, illustrated booklet

MARQUETTE MFG. CO., INC.
Minneapolis 14, Minnesota

MARQUETTE
REGISTERED U.S. PAT. OFFICE

a.c. arc welders

ABOUT PEOPLE

George L. Wiley, better known as "Duke," has joined the Big Three Welding Equipment Co., Houston, Tex., as welding consultant. Mr. Wiley has been promoting the use of arc welding for the past 26 years. He was the founder of the first Fusion Forum and has held committee chairmanships in both the American Welding Society and the American Society for Metals. He was one of the first to undertake the arc welding of oil storage tanks and the welded steel construction of buildings.

» «

A. C. Streamer, vice-president of the Westinghouse Electric and Mfg. Co., has been elected president of the National Electrical Manufacturers Association. Mr. Streamer has been with Westinghouse since 1907. He was chosen to head the switchgear division as manager in 1936, became general manager of the East Pittsburgh division in 1939 and was elected a vice-president two years later. Last year he assumed new duties at company headquarters in Pittsburgh.

» «

Edward C. Fales has been appointed assistant to the president of The American Welding & Mfg. Co., Warren, O. He was formerly assistant to the general manager of operations of Sylvania Electric Products Co. and prior to that an industrial engineer with the Carnegie-Illinois Steel Corp.

» «

Paul James, formerly at Rochester, has been transferred to the Syracuse office of The Lincoln Electric Co., 517 Erie Boulevard E. **E. I. Smith** has been appointed district manager at Rochester to take the place of Mr. James. **George S. Stevens** has been transferred from the Lincoln factory at Cleveland to Charlotte, N. C., as field representative and engineer.

FOR WELDERS ON EXPOSED JOBS!

the M·S·A COMBINATION SKULLGARD-WELDING SHIELD

This practical combination benefits today's welders in shipbuilding, steel, oil, construction, and all other industries where head hazards, bumps and falling objects are encountered. Combining the safety of a laminated bakelite cap-type Skullgard for proved head protection with a one-piece welding shield of tilting design, better comfort and efficiency is assured on the job. The welding shield has a leak-proof lens holder—the Skullgard cap can be worn separately for other work when desired. Ask for Bulletin No. CE-9!

MINE SAFETY APPLIANCES COMPANY
BRADDOCK, THOMAS AND MEADE STREETS · PITTSBURGH, PA.
District Representatives in Principal Cities

P&H WELDING POSITIONERS

WELD FASTER, EASIER, AT LOWER COST!

Model WP-2—2500 lbs. Capacity

There are more big time-and-money-saving advantages in this new P&H WP-2 Welding Positioner than you would believe possible — at such surprisingly low cost.

The WP-2 is the most versatile positioner in its class — easiest to operate. Of all-welded steel construction with large table area and hydraulic power tilting — it is available with manual, handwheel or power turning. Has positive table locking device — telescopic elevation.

Write for Free Bulletin

. . . of facts and pictures giving complete story! Start now to save time, costs by positioning your work. It shows you how! Ask for Bulletin P2-1.

General Offices: 4513 West National Ave., Milwaukee 14, Wis.

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ARC WELDERS · EXCAVATORS · ELECTRIC CRANES · P&H · MOTORS · HOISTS · WELDING ELECTRODES

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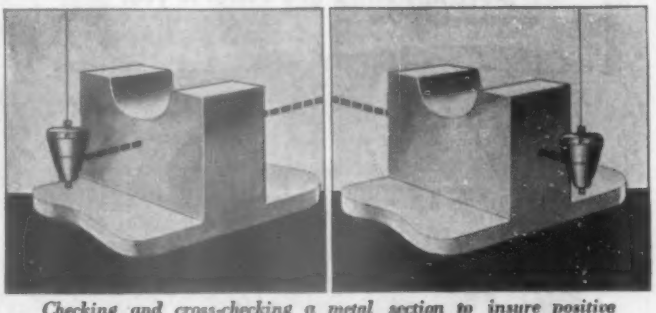
CANADIAN RADIUM IN MODERN INDUSTRY

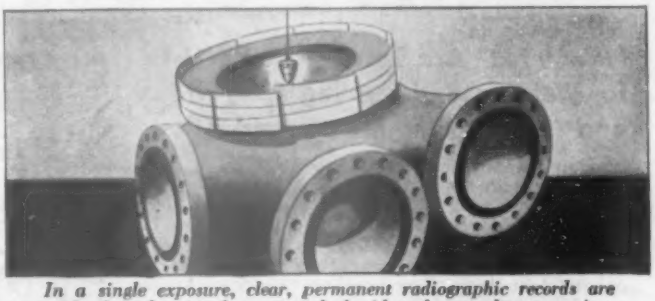
EASY WAY TO DETECT INTERNAL FLAWS

CANADIAN RADIUM SAVES

TIME, LABOR, MATERIALS — INSURES SOUND PRODUCTION



Checking and cross-checking a metal section to insure positive detection of flaws, such as tight cracks, is easy with radium. Its Gamma-rays penetrate up to 10 inches of solid steel.



In a single exposure, clear, permanent radiographic records are made through critical areas on both sides of a ponderous casting, simply by suspending a radium capsule inside the aperture.

R-34

Write for Free Manual

Reliable, profusely illustrated 80-page textbook on the fundamentals and technique of modern Industrial Radiography of Metals with Radium. Specially prepared for the metals industry by our research and technical staff. Write for your copy today, giving your name and company position.

CANADIAN RADIUM & URANIUM CORPORATION
630 FIFTH AVE., ROCKEFELLER CENTER, NEW YORK 20, N.Y.

The sales engineering and development division activities of Aluminum Co. of America are being expanded with the appointment of three men to head special activities. **Frank Jardine**, who has been in charge of development work in Cleveland, has been given the title of manager of development division, Cleveland branch. **John R. Willard** has been placed in charge of the sales development division located at New Kensington, Pa., and **B. J. Fletcher** has been appointed chief engineer of the New Kensington branch.

» «

Everett S. Lee, engineer of The General Electric Engineering Laboratory, General Electric Co., Schenectady, was reelected chairman of the Engineers' Council for Professional Development at the recent 1944 annual meeting. **James W. Parker**, president and general manager of The Detroit Edison Co., was reelected vice-chairman. **R. L. Sackett**, assistant to the secretary, ASME, New York City, and **George T. Seabury**, secretary of ASCE, were elected secretary and assistant secretary, respectively.

» «

Charles E. Martin, formerly welding instructor at Illinois Institute of Technology, Chicago, has joined the staff of Miller Electric Mfg. Co., Richmond, Ind.

» «

L. E. Phelps has been appointed direct factory representative for the Michigan Tool Co., with offices at 638 Baker Bldg., Minneapolis.

S. M. Rust, Sr., retiring president of The Rust Engineering Co., Pittsburgh, has been elected chairman of the board of directors, and **S. M. Rust, Jr.**, who has been serving as executive vice-president, has been elected president.

» «

C. E. Plass has been appointed district engineer in the electrical sales division of the Chicago office of the American Steel & Wire Co. **Victor Siegfried** has been named to succeed Mr. Plass as chief research engineer of the electrical cable works at the company's Worcester, Mass., plant.

» «

John J. Farrell has been appointed treasurer of the American Steel & Wire Co., Cleveland. He was formerly assistant treasurer. In his new position, Mr. Farrell succeeds **Robert E. Lewis**, who has become president of the Cleveland Wire Spring Co.

» «

Ellis L. Spray has been elected vice-president and general manager of the Westinghouse Electric Elevator Co., succeeding **Frank C. Reed**, retired. He will also continue his responsibilities as assistant to the president in charge of the headquarters manufacturing division of the parent company.

» «

Fred Grotts, formerly president of the Fort Pitt Steel Casting Co., subsidiary of H. K. Porter Co., Inc., of Pittsburgh, has been appointed to the newly created position of director of research and metallurgy for all of the Porter plants.

» «

Thomas M. Thornton has been appointed field engineer in Detroit by Norton Co., Worcester, Mass. **R. C. Willey** has been appointed abrasive engineer in Pittsburgh, and **Ralph E. Rasmussen** has been appointed to Mr. Willey's former position as office manager of the Norton Pittsburgh warehouse. **R. H. Langdon** has been appointed abrasive engineer for Vermont, New Hampshire, western and southern Massachusetts and Rhode Island. **E. L. Hurst** has been appointed field engineer for New York City and northern New Jersey.

» «

William T. Laughlin, formerly welding instructor at Greer Shop Training, Inc., Chicago, has joined the field organization of The Sight Feed Generator Co., Richmond, Ind. He will cover the states of Ohio and Pennsylvania in the capacity of district manager.

» «

Charles H. Slaughter, well known as a machine tool executive and sales engineer, has been named national sales manager for Thomas Machine Mfg. Co., Pittsburgh. He will head the expanded sales program that is shortly to be announced by this company.

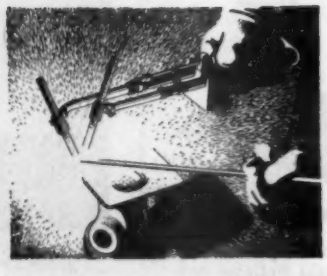
New 9000° Arc Torch Can Be Used for Welding and Brazing All Ferrous and Non-Ferrous Metals and Alloys

Now an arc torch that makes it possible to do most jobs *electrically* that previously were thought possible only with gas. This attachment for arc welders provides an independent source of heat by means of two carbons. It is capable of producing intense heat, approximately 9000° F., over 2000° hotter than an oxyacetylene flame. Pure heat, no oxygen or gas to contaminate the weld. No pressure to force the molten metal away or blow holes in light sections.

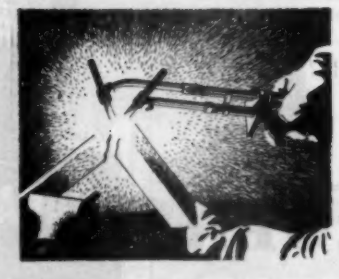
Developed to capitalize to the fullest on the time-saving advantages of electric welding, the new Mid-States 9000° arc torch can be used with any AC or DC electric welder. It opens up new horizons of service in this field, never before possible with an electrically operated instrument.

New uses are being found every day for products that have been familiar to us for years. Wrigley's Spearmint Gum, always enjoyed for its chewing satisfaction, is now proving with the fighting men overseas many benefits which will be useful to you in peacetime. One of the big factors in mass production is the alertness and efficiency of the man on the job. The chewing of Wrigley's Spearmint will help keep you alert and wide-awake during those work periods that, while seemingly dull and monotonous, call for watchfulness in order to get perfection in the final assembly.

You can get complete information from Mid-States Equipment Co., 2429 S. Michigan Ave., Chicago 16, Illinois.



For BRAZING Steel, Cast Iron, Malleable Iron, Copper, Brass, Bronze, and other ferrous and non-ferrous metals.



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The RIGHT FLUX for the JOB

No. 2 FLUXINE for brazing and bronze welding—copper, copper alloys, malleable iron and steel.

No. 6 FLUXINE . . . non-glaring . . . for bronze bonding—cast and gray iron with bronze and nickel alloy rods.

No. 7 FLUXINE for welding all types of aluminum.

No. 18 FLUXINE for gas and atomic hydrogen welding of stainless steels and inconel.

No. 41 FLUXINE used with high-melting silver solders on copper and its alloys and on steel.

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Wherever a flux is required "FLUXINE" Flux will do it better and more economically. Write us today for sample. Address Dept. G.

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Excels in Welding of all Light Gauges!

Handles any Type or Kind of Arc Welding Electrode!

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A. C. Arc Welder

Built-in High Frequency Circuit Strikes Arc Easily With 1 or 100 Amperes!

Right now, in scores of huge industrial plants, POSITIVE ARC Welders are meeting the demand for high quality welding at low operating cost, plus 24 hours a day service. Here's a rugged, highly efficient welder — with features found in no other welding equipment. It is simple to operate, dependable and safe, and will do a better and faster welding job.

Available in 4 sizes 60-155-255-355 Amperes

● *Exclusive Distributor Franchises Still Available*

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Superior HIGH-PRESSURE GAS CYLINDER VALVES

Write for Catalog

Packed and Diaphragm Packless Valves . . . for use with Hydrogen, Ethylene, Nitrous Oxide, Carbon Dioxide, Medical and Commercial Oxygen, Oil-pumped and Water-pumped Nitrogen.

THE INDUSTRY STANDARD—not a revolutionary design—improved to prolong its years of service—reduce maintenance cost—increase its margin of safety.

SUPERIOR hot-forged valve bodies are *generously* heavy—especially around the packing nut and stem—to provide the *extra* strength which many years of experience indicate is required to enable the valves to successfully withstand the abuse to which they are often subjected. The heavy knurled octagon handwheel provides excellent gripping surface—replacement parts are interchangeable with other valves of similar size and design.

Superior safety device specifications are on file with Bureau of Explosives, for convenience in obtaining prompt approval for use in interstate commerce.

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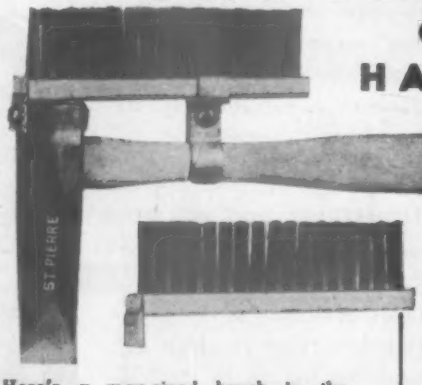
OFFICES IN PRINCIPAL CITIES . . . WEST COAST STOCK, LOS ANGELES (15) JOBBERS EVERYWHERE

ABUSE MEANS NOTHING TO ST. PIERRE CHIPPING HAMMERS



Here's a man-sized brush in the right position for easy use after chipping scale from welded surface. Hammer-Chisel made of highest quality tool steel. Entire tool is well-balanced. For economy, for durability use ST. PIERRE Hammers.

Breaks the Scale Cleans the Surface in One Operation

Order Today From Your Jobber or Direct

ST. PIERRE Chain Corporation

WORCESTER DROP FORGINGS MASSACHUSETTS

NOW COMPLETE PORTABLE SHAPE CUTTING FACILITIES

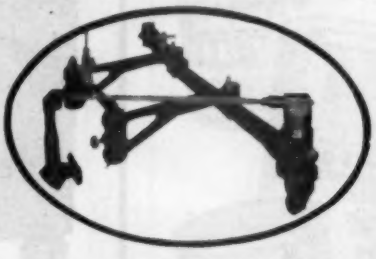
To the popular uses of portable cutting machines there has now been added the luxurious control-ease and accurate shape cutting reproduction of high priced shape cutting machines. Every Steel Fabricating Shop needs the new popular priced GASO V-10 with automatic shape cutting attachment. Tracing irregular shapes and circle cutting are made easy and accurate on the new GASO V-10 with automatic shape cutting attachment. Optional attachment allows spindle head operation and template head operation, the latter enabling large quantities of duplicate parts to be automatically and accurately flame cut.

GASO V-10 CUTTING MACHINE WITH TRACING HEAD MOUNTED FOR OPERATION. The template is shown on the left and the spindle head at the right.

GASO V-10

TWO MACHINES IN ONE

All portable, the new, popular priced GASO V-10 with automatic shape cutting attachment performs the functions of two machines in one: Automatic straight line cutter and automatic shape cutter. The GASO V-10 with automatic shape cutting attachment is: motor driven; fully automatic on all shapes; adjustable 3"—60" per minute; designed for instant start and stop; and equipped with unitary shut-off valve. The GASO V-10 is equipped with 5 foot track—cutting table optional.



Shape Cutting Attachment.

Some Distributor Territories Still Available.
Write today for new bulletin giving full information.

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TRINDL SUPER INDUSTRIAL ARC WELDER

DESIGNED FOR HIGH SPEED PRODUCTION ARC WELDING

TRINDL SUPER INDUSTRIAL ARC WELDERS, the result of many years of careful engineering and "job tested" research, are rolling up impressive production records. Acclaimed for superior performance, ruggedness, dependability, and economical operation.

For better, faster welding, easy-to-operate TRINDL SUPER INDUSTRIAL ARC WELDERS will help step up your production schedules 20% to 40%. Manufactured in a range of distinctive sizes to accommodate every type of shop and production welding job.

Trindl Welders, Electrodes, supplies and accessories, available for immediate delivery, will save you both time and money. Write, wire or phone for full details.

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R. W. Davis has been appointed general manager of the Norwood, O., works of the Allis-Chalmers Mfg. Co. He was formerly assistant manager of the company's electrical department at Milwaukee but has been on leave for two years to serve as director of the Electrical Equipment branch of the War Production Board.

» «

Oscar M. Havekotte, of Columbus, O., has been elected a director of Dresser Industries, Inc. Mr. Havekotte has been for the past four years president of International-Stacey Corp. and of International Derrick and Equipment Co. He will continue to head the latter company, but the International-Stacey Corp. has been acquired by Dresser Industries and will be dissolved.

» «

John J. Davis, Jr., has been appointed manager of railroad materials sales of Carnegie-Illinois Steel Corp., Chicago, and **John A. English, Jr.**, has been appointed assistant manager. **Marcus J. Aurelius** has been appointed assistant to manager of sales in the railroad materials and commercial forgings division in Pittsburgh.

» «

Willis Ahlborn Kropp has joined Aircraft Parts Development Corp., Summit, N. J., as industrial design engineer and stylist.

Died . . .

J. W. Sullivan, chairman of the board of Skilsaw, Inc., died Oct. 26 at his home in Evanston, Ill. He was 73 years old. Mr. Sullivan was the founder of Skilsaw, portable electric tool manufacturer, of which he became president in 1926. He was elected chairman of the board in 1942 when his son, Bolton Sullivan, became president of the company.

» «

Dudley Hobart Miller, president of the Speer Carbon Co., St. Marys, Pa., died on Nov. 8 at his home in St. Marys following an illness of eight months. He was 74 years old.

In his early life, Mr. Miller was engaged in various enterprises, including gold mining both at Tonapah and Gold Field. In 1910 he came east where he associated himself in both a technical and administrative capacity with various industries and various projects. In 1930, when the International Graphite & Electrode Corporation was organized in Niagara Falls, N. Y., as a subsidiary of Speer Carbon Co., Mr. Miller assumed the direction of that company as president and general manager.

At the time of his death he was president and director of Speer Carbon Co.; president and director of International Graphite & Electrode Corp.; president and director of International Graphite Corp. of Canada, Ltd.; president and director of Speer Resistor Corp.; executive vice-president and director of the Duriron Co., Inc., and treasurer of the Guerrero Trading Co. of Mexico.

National
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EFFICIENT

ECONOMICAL

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For
Welding and Cutting
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START THE ARC *Automatically*

NO PECKING
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MISSING LINK AUTOMATIC ARC HY CYCLE UNIT **$59.50** COMPLETE

★ It's easy to start the arc with this new advancement in electric welding . . . the "MISSING LINK." Arc starts automatically without the annoying, tiresome, obsolete method of "pecking" and "scratching" the work to get going. Attach "Missing Link" to any arc welder, AC or DC. Use any type of welding rod and get faster, better welding with greatly reduced operator fatigue. What's more, beginners can become experts almost overnite with the aid of this unit. Makes work far easier for experienced welders.

Multiply your man-hours and get many other cost-reducing advantages, by equipping with the "Missing Link." Act now! Get complete details on this low-cost, time-saving unit.

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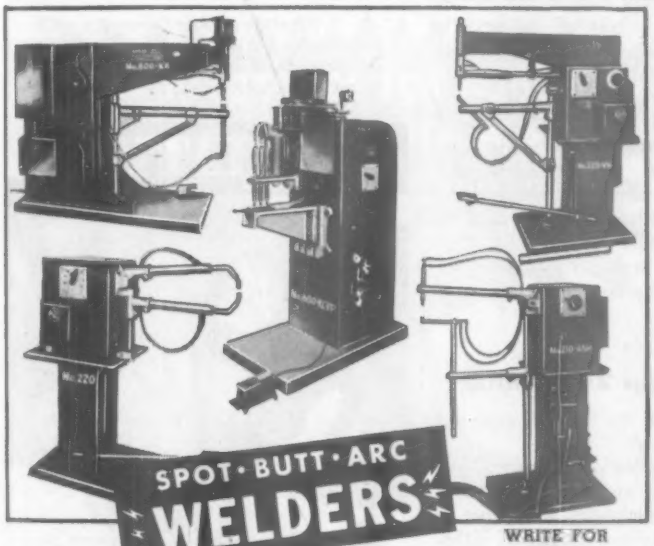

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We manufacture a complete line of resistance spot welders from ¼ to 300 KVA for all types of welding. There is an EISLER WELDER for every purpose.

TRANSFORMERS OF ALL TYPES

WE INVITE CONTRACT SPOT WELDING IN LARGE OR SMALL QUANTITIES.

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THROUGHOUT THE WORLD

Cast Aluminum Welding Rods
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THE CHICAGO HARDWARE FOUNDRY CO.
Dependable Since 1897
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Glen Schwander says:

about Thermacote PLASTIC COATED COVER LENSES

"We find that a Thermacote cover lens lasts, on the average, 20 days per welder, whereas the clear glass we formerly used had to be changed one or two times daily. Even on over-head welding we get about 5 days use with one Thermacote cover lens."

Mr. Schwander is welding superintendant for the Weber Showcase and Fixture Company, Inc., which company has made an outstanding record in the production of war materials. They operate one of the largest metal presses in existance, and most of their welding is done in the building of life rafts.

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Do You Agree?

If you, as a reader, do not agree with our answers, let us know your thoughts. Your comments and discussions will be published, too.

Acid and Basic Steels

Q—What is the difference between acid and basic steels?—*T. E. B.*

A—Acid steel is a term applied to steel melted under a slag which has an acid reaction and melted in a furnace having an acid bottom and lining. Basic steel is melted under a slag having a basic reaction in a furnace having a basic bottom and liner.

» «

Brittleness in Welds

Q—What is the cause of brittleness in a welded joint? How may brittleness in welds be eliminated?—*M. O.*

A—Weld brittleness may be caused by one of several reasons. The most common causes are improper heating, unsatisfactory electrodes and the use of an air-hardenable base metal.

Brittleness may be overcome in four ways: (1) Preheating medium carbon and certain alloy steels at 300 to 500 F offsets the tendency of the heat-affected joint to become hard as a result of rapid cooling. (2) Annealing at 1100 F after welding will generally soften the hard areas formed during welding. (3) Austenitic electrodes are sometimes desirable for air-hardenable steels. The increase in weld ductility compensates for the brittleness of the heat-affected areas in the base metal. (4) Multiple-layer welding tends to anneal the hardened zone, thereby reducing the probability of brittleness.

» «

Chilled Inert-Gas Arc Welding

Q—What is meant by chilled inert-gas arc welding?—*R. O. B.*

A—This is an arc-welding process, developed for use in the arc welding of magnesium alloys, in which the arc flame is chilled in an inert-gas atmosphere of either helium or argon For details regarding this welding process see September, 1942, issue of THE WELDING ENGINEER, page 27; the December, 1942 issue, page 30; January, 1943, page 46, and the November, 1944, issue, page 44.

» «

Macrographic Inspection

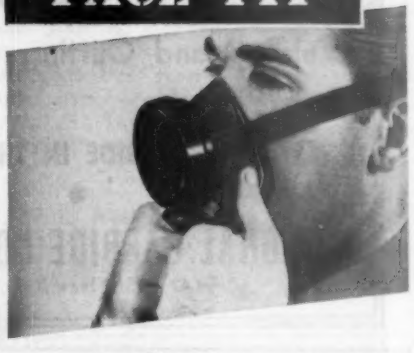
Q—What is meant by the term "macrograph," frequently used in connection with the examination of welds?—*G. E. Q.*

A—A macrograph is a photographic reproduction of any object which has been magnified not more than ten times. If magnified more than ten diameters, the photograph is referred to as a micrograph.

APPROVAL

The new Willson No.45 Respirator has Bureau of Mines approvals for toxic dusts and pneumoconiosis-producing dusts and mists in such operations as crushing, grinding, milling and abrading.

FACE FIT



Flexible rubber facepiece with adjustable spring gives comfortable but snug fit. Elastic headband maintains dust-tight seal.

UTILITY

Filters easily replaced in screw-type assembly. Replacement filters low in cost. Foolproof assembly assures proper operation after replacement.

Get in touch with your Willson Safety Service Distributor for full information on new No. 45 Respirator. Or, write to Dept. WE-3.

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For Better and Easier Welding

DUCTONE AC

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WELDING RODS

Prompt delivery can be made on DUCTONE AC rods, the electrode that has been designed especially for AC welding. This is a premium quality electrode that is far superior to all other AC rods. It is noted for its extra-stabilization in the coating, which makes striking and maintaining an arc easy, and for its all position use . . . Small sizes are especially good for thin sheet metal. Excellent for vertical and overhead welding on DC positive polarity. Extruded all sizes from 1/16" to 1/4" See your dealer.

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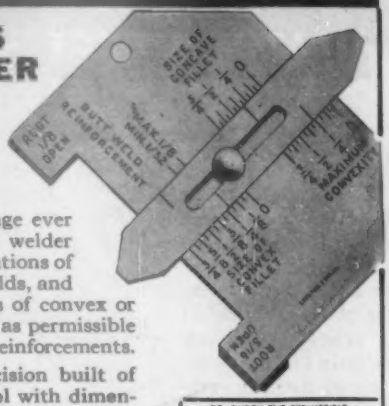
PALMGREN

WELDER'S MICROMETER

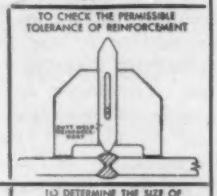
For Accurate Calibration of BUTT & FILLET TYPE WELDS

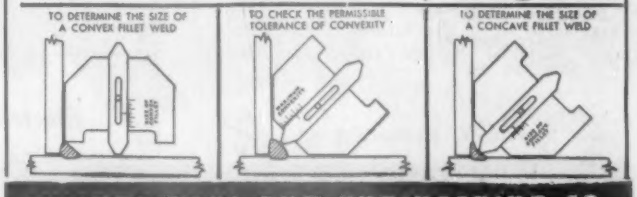


The finest welding gage ever developed. Enables a welder to meet exact specifications of butt and fillet type welds, and accurately check sizes of convex or concave fillets as well as permissible tolerance of butt weld reinforcements.

Instrument is precision built of chromium plated steel with dimensional readings clearly indicated. Made pocket size 2½" x 3" very handy and easy to operate. Eliminates rejections. Saves time and electrodes. Was $3. Now only $1.95

Write for details and Welding Symbols Chart




TO DETERMINE THE SIZE OF A CONVEX FILLET WELD
TO CHECK THE PERMISSIBLE TOLERANCE OF CONVEXITY
TO DETERMINE THE SIZE OF A CONCAVE FILLET WELD

CHICAGO TOOL AND ENGINEERING CO.

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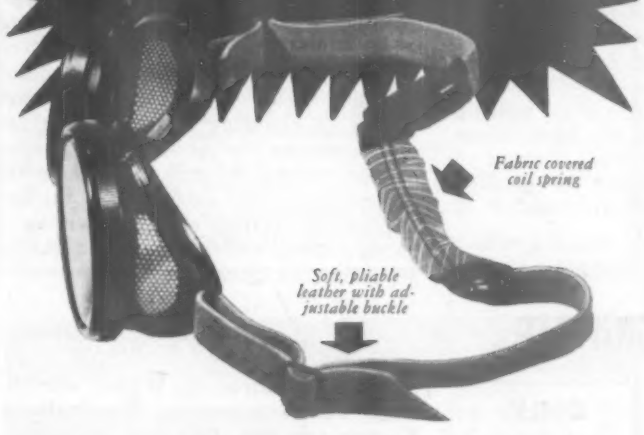
NEW HEADBANDS FOR GOGGLES
HOLD-TITE IS THE NAME



Here's a new long-lasting spring and leather headband that fits *all* welding and grinding goggles. Will replace your old elastic or rubber headbands and last indefinitely. Hold-Tite headbands combine a fabric covered coil spring with a leather strap assembly—will not dry out, weaken, or become over-stretched from perspiration. Insist upon Hold-Tite non-rubber headbands. 25c each. Immediate delivery

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●

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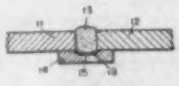
FROM THE PATENT OFFICE

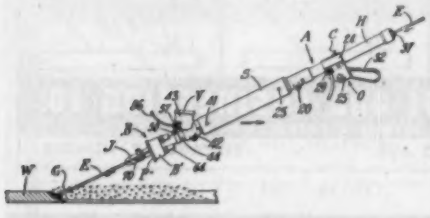
Weld Back-up Strip

2,362,505. **Emmett A. Smith,** East Cleveland, O., assigned to **The Lincoln Electric Co.,** Cleveland. Filed Dec. 27, 1940. Issued Nov. 14, 1944.



A backing device for closing and forming the underside of a seam in fusion welding. It includes a metal backing strip having a surface of the same shape as the surface of the desired weld and a replaceable layer of flexible fibrous glass tape. The latter is free of substances capable of evolving gases. The glass tape is relatively thin compared with the thickness of the strip and is fusible at welding temperature. The strip has a means to limit the lateral flow of the glassy material despite fused condition.

» «

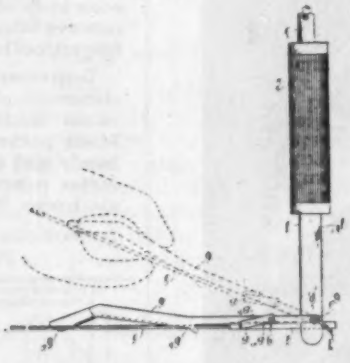


Submerged-Melt Welding Head

2,361,918. **Albert W. Baird,** Cranford, N. J., assigned to **The Linde Air Products Co.** Filed Dec. 18, 1942. Issued Nov. 7, 1944.

Feeding apparatus for a submerged-melt automatic welder. Elements are: a tubular handle, a sleeve secured to handle, a bus-bar assembly secured to sleeve, a member reciprocably mounted in the handle and adapted to receive welding wire, a feeding mechanism slidably mounted in the sleeve and operatively associated with the reciprocable member, a manually operable means mounted on the handle to move the member and mechanism in one direction and a resilient means mounted on the sleeve to move the mechanism and member in the opposite direction. Mechanism, upon movement in one direction, is adapted to grip the welding wire and advance it toward the work. Upon movement in the opposite direction, mechanism is adapted to move freely along the welding wire. Movement of the welding wire is restrained upon movement of the mechanism and member in the aforementioned opposite direction.

» «



Electrode Holder

2,361,284. **Ronald MacDonald,** Gooderham, Toronto, Ontario, Canada. Filed June 29, 1943. Issued Oct. 23, 1944.

This patent pertains to a means in an electrode holder for supporting an electrode with its end in contact with a stub held by the holder so that electrode and stub may be welded together. The holding means is movable out of supporting position after the electrode and stub have been fused.

» «

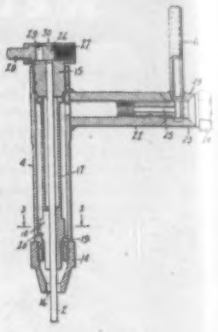
Arc-Welding Flux

2,360,716. **Vladimir Peters,** Lakewood, O., assigned to **The Lincoln Electric Co.,** Cleveland. Filed Aug. 5, 1942. Issued Oct. 17, 1944.

An unfused flux for use in arc welding having a composition of: from about 30 to 65% silica sand, from about 2 to 15% cryolite, from about 10 to 25% oxide of manganese, from about 10 to 25% silico manganese.

Atomic-Hydrogen Welding Tip

2,361,896. **John R. Yeadon,** Lynn, Mass., assigned to the **General Electric Co.,** Schenectady, N. Y. Filed Oct. 2[illegible] 1943. Issued Oct. 31, 1944.



Atomic-hydrogen welding apparatus comprising a nozzle having one end of an electrode passageway located in the tip and an electrode-holding means for engaging an electrode in the passageway at a point near the tip. There is also a means for supplying gas through the nozzle and tip about the arcing terminal of an electrode and a valve for opening and closing the other end of the electrode passageway. In its open position, the valve forms a substantially gastight fit about the electrode, and in its closed position it closes the passageway to prevent the escape of gas. The stub end of an electrode in the nozzle may thus be used until it becomes too short for the electrode-holding means.

» «

Helmet Friction Joint

2,360,101. **Charles Evans Bowers,** Moylan, Pa. Filed March 30, 1942. Issued Oct. 10, 1944.

This patent applies to a welding helmet of the type in which a shield is pivotally mounted on a headband by a friction joint having a non-rotative mounting with respect to one of these members. The improvement consists of a pivotal frictional assembly including a cup bearing and a cup-shaped washer arranged to aid the bearing in clamping the shield and headband in the desired relation to each other. A bolt-and-nut assembly holds the cup bearing and washer in clamping relation. There is also a means for establishing a non-rotative relation between one of the parts of the nut-and-bolt assembly and the cup bearing. A spring aids in exerting a yielding friction to rotation between the headband and shield.

» «

Welding Circuit

2,359,178. **Alfred B. White,** Murrysville, Pa., assigned to **Westinghouse Electric and Mfg. Co.,** East Pittsburgh. Filed May 8, 1943. Issued Sept. 26, 1944.

A welding circuit connecting a reactance energy storage means to an a-c source for charging. A reactance means of the opposite phase relation is connected in shunt circuit relation with the energy storage means to provide an energy power circuit resonant at substantially the frequency of the source. A switch connecting the energy storage circuit provides a discharge circuit through the welding circuit.

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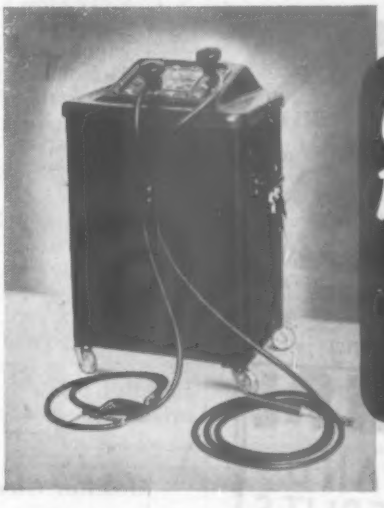

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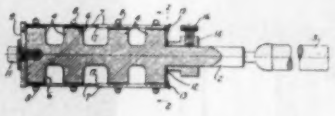
Flash-Welding Apparatus

2,359,324. **Michael L. Marcoux,** Detroit, assigned to **Progressive Welder Co.,** Detroit. Filed July 14, 1942. Issued Oct. 3, 1944.

This patent covers a means for supporting a pair of workpieces, a fluid motor for effecting a feed movement, a means for passing a current of arclike character between the workpieces, and a means for stopping the fluid motor. The last-mentioned means is controlled in accordance with the heating action on the workpieces.

» «



Butt-Welding Jig

2,359,525. **Radford Leonard** and **Francis Migge,** San Bruno, Calif., assigned to **Eitel-McCullough, Inc.,** San Bruno. Filed Dec. 14, 1942. Issued Oct. 3, 1944.

A jig for butt welding metal rods. It includes a frame having spaced supports and a means associated with them for slidably holding the rods in axial alignment. The opposing ends of the rods lie in the space between the supports, and a resilient means on the frame presses them into abutment.

» «

Helmet Attachment

2,359,164. **Guy M. Shipp,** Navy Yard, S. C. Filed April 8, 1943. Issued Sept. 26, 1944.

In combination with a weldor's helmet having an observation window, a tube of opaque material that excludes light except through its own window. The latter is located on a lateral extension of the tube at an angle to the helmet window.

First and second reflectors within the tube receive an image through the second window and reflect it through the first or helmet window. The first reflector is disposed in an offset above the base of the second window, and the other reflector is in front of the first one and disposed below it. The second or tube window has a protecting light therein.

» «

Monitor Circuit for Welders

2,360,068. **Frank Martindell,** Western Springs, Ill., assigned to **Western Electric Co., Inc.,** New York City. Filed Aug. 6, 1942. Issued Oct. 10, 1944.

A monitoring apparatus for contact welders comprising: a welding transformer having primary and secondary windings; a resistor in series with the transformer primary; a bridging transformer having its primary winding in parallel with the primary of the welding transformer; a rectifier shunting a part of the resistor; a rectifier connected to the secondary of the bridging transformer; a means controlled by the rectifiers jointly for indicating the energy expended in making a weld.

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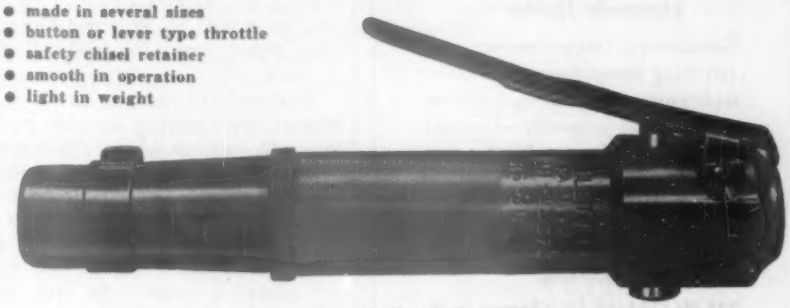

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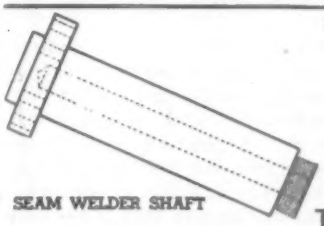

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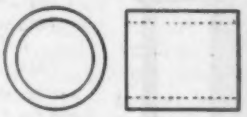

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Eye Shield

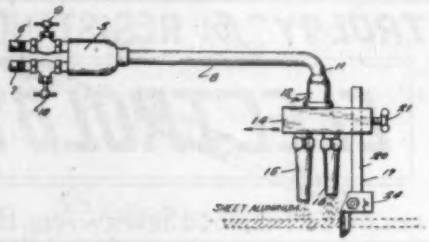
2,359,435. **Gray Miller, Jr.**, Southbridge, Mass., assigned (by James C. Gahan, Jr., administrator of Gray Miller, Jr., deceased) to **Polaroid Corp.**, Dover, Del. Filed Aug. 26, 1941. Issued Oct. 3, 1944.

The body of this eye shield is a transparent sheet having a notch in its lower edge to engage about the nose of the wearer and lower edges on opposite sides of the notch to engage with the wearer's face beneath the eyes. A band is fastened to opposite ends of the body portion to secure the shield to the wearer's head. An element secured to and projecting rearwardly from the inner face of the shield serves to space its upper margin from the wearer's forehead and thereby provide ventilating spaces.

» «

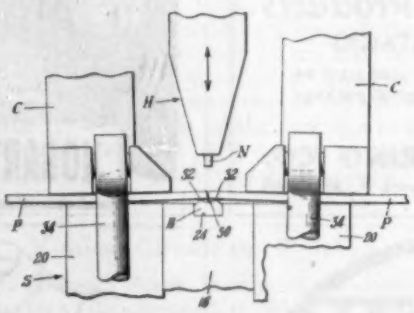
Aluminum Cutting Method

2,358,772. **George F. Brow**, East Braintree, and **Frank E. Rioux**, North Attleboro, Mass. Filed Nov. 20, 1943. Issued Sept. 26, 1944.



A method of cutting sheet aluminum. The aluminum is first heated in a relatively narrow band by progressively moving a heat source across the surface of the sheet. A moving blade immediately follows along the heated band, cutting simultaneously through both the upper and lower surfaces of the sheet.

» «

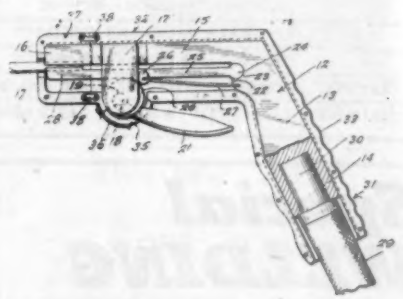


Welding Fixture

2,359,352. **James H. Bucknam**, Cranford, and **Winslow B. M. Clark**, Plainfield, N. J., assigned to **The Linde Air Products Co.**, New York City. Filed Oct. 31, 1939 (original application). Issued Oct. 3, 1944.

A grooved support for use in forming fusion welds in metal strips. A clamping means is adjustably secured to the support on either side of and parallel with the groove in its upper surface. A member formed of metal of a high coefficient of heat conductivity is seated in the groove and is substantially coextensive in length with it. The upper surface of the latter member consists of two spaced parallel work-contacting edges that project slightly above the upper surface of the support and are adapted to make line contact with the bottom surfaces of the strips to be welded. A concave surface between the work-contacting edges is adapted to underlie the abutting edges of the work.

» «



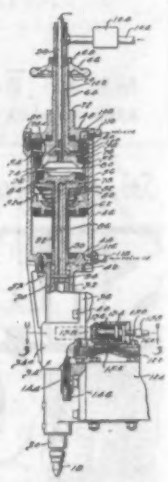
Electrode Holder

2,358,800. **Hardick F. Fuller**, Portland, Ore. Filed May 4, 1943. Issued Sept. 26, 1944.

An electrode holder with a socketed body of conducting material to accommodate the lead-in. A limb on the body terminates in a jaw, and there is a seating notch at the juncture of limb and body. One of the jaw members is barlike and relatively movable; this member has a detent at one end that is rockable in the seating notch and a jaw at the opposite end opposed to another jaw. The barlike jaw member is provided with keepers; a spring engages at one end in the keepers and at its opposite end to the junctural portion of the body and limb. A rockably mounted cam carried by the limb is engageable with the intermediate portion of the movable jaw. All of these parts are enclosed in a structure of insulating material.

» «

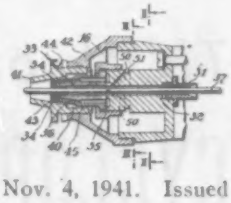
Spot-Welding Mechanism



2,358,826. **Hugo Purat**, Detroit, assigned to **Progressive Welder Co.**, Detroit. Filed May 19, 1941. Issued Sept. 26, 1944.

This patent refers to a spot-welding machine having a primary cylinder, a primary piston slidably received in the cylinder and formed to define a second cylinder space and a secondary piston received in the last mentioned cylinder space. An elastic fluid is continuously introduced into the second cylinder space so as to act against the secondary piston. There is also a selectively controllable means for introducing fluid pressure into the first-mentioned cylinder space.

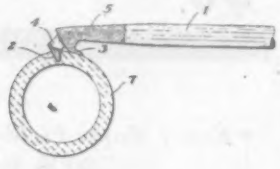
Metallizing Improvement



2,361,420. **Arthur P. Shepard**, Forest Hills, N. Y., assigned to **Metallizing Engineering Co., Inc.**, Long Island City, N. Y. Filed Nov. 4, 1941. Issued Oct. 31, 1944.

An improvement in a metallizing gun of the type having a gas-blast duct and a wire-feed duct for feeding a metal wire to the melting zone. The improvement consists of a number of holes around the wire-feed duct and a number of bleeding gas passages converging on the feed duct in the direction of wire feed and terminating in the holes in order to connect them with the gas-blast duct. The holes and the passages are positioned and dimensioned to bleed sufficient gas into the duct to overcome the pressure at the nozzle tip of the gun. The bleeder holes are spaced a considerable distance from each other in order to reduce fluctuation of the wire tip in the melting zone.

» «

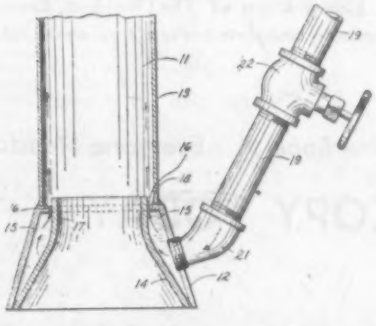


Plastic Welding Tool

2,360,950. **Frederick P. Kilgour**, Niagara Falls, N. Y., assigned to **E. I. du-Pont de Nemours & Co.**, Wilmington, Del. Filed Feb. 15, 1943. Issued Oct. 24, 1944.

A heat-conducting tool for welding thermoplastic organic materials. A shank of heat-conducting metal terminates in a relatively narrow welding tip directed at an angle to the axis of the shank. A flat spreading member, substantially wider than the tip and formed integrally with the shank at the rear of the tip, is adapted to spread the material softened by the heat of the tip.

» «



Welding-Fume Siphon

2,361,861. **Frank Masowich**, Lorain, O. Filed Feb. 9, 1944. Issued Oct. 31, 1944.

A portable air siphon for the removal of welding fumes. It consists of an outer funnel having a secondary funnel inside. The receiving mouths of the outer and secondary funnels are sealed together. The secondary funnel has a greater taper than the outer funnel in order that a chamber may be formed between the walls of the two funnels. The outer funnel has a discharge throat, adjacent and spaced radially from the secondary funnel, that forms a restricted discharge opening to the chamber. A discharge tube is connected to the outer funnel immediately above the discharge throat. A flexible conduit for feeding compressed air to the chamber and a valve associated with it are disposed adjacent to the outer funnel to control the rate of discharge of the gas in the vicinity of the air siphon and the dilution of the gas discharged.

» «

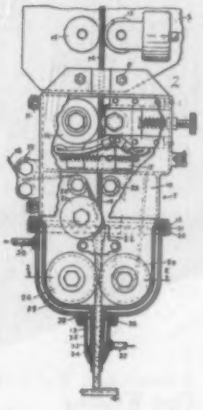
Soldering Flux

2,361,867. **Leopold Pessel**, Philadelphia, assigned to **Radio Corporation of America.** Filed Feb. 1, 1943. Issued Oct. 31, 1944.

A solder fluxing agent having a principal ingredient selected from the group consisting of keto fatty acids and substitution products thereof and a solid carrier for this material.

» «

Arc-Welding Head

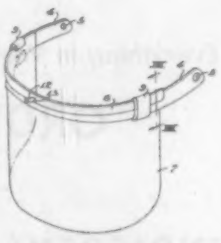


2,360,409. **Kenneth R. Evans**, Lakewood, O., assigned to **The Midland Steel Products Co.**, Cleveland. Filed June 29, 1942. Issued Oct. 17, 1944.

A casing having a means for guiding welding wire through it and a cooling jacket. The jacket is spaced from the casing and is substantially co-extensive with its bottom. A coolant is supplied to the space between the casing and the jacket.

» «

Face Shield

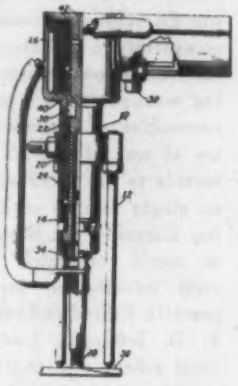


2,360,482. **Robert B. Evans**, Penn Township, Allegheny County, Pa., assigned to **Mine Safety Appliances Co.**, Pittsburgh. Filed July 8, 1943. Issued Oct. 17, 1944.

A face shield having a transparent sheet extending downward from a supporting band adapted to extend around the front of the wearer's head. Upper edge portion of the sheet is folded over the top of the band. A C-clip slidably mounted on the band is movable to a position in which its ends are hooked over the top of the sheet and under the bottom of the band in engagement with the latter.

» «

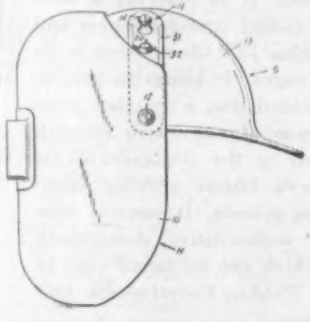
Stud-Welding Gun



2,360,837. **Andrew W. Anderson**, Vallejo, Calif. Filed July 29, 1943. Issued Oct. 24, 1944.

This welding device has a leg element adapted to be positioned against the work and a means for supporting a stud. A spring positions the forward end of the stud farther forward than the forward end of the leg element. The spring is adapted to yield until the end of the stud and the end of the element are in the same plane. Supporting means and stud are movable with respect to the remainder of the device. An electromagnet retracts the supporting means until the end of the stud is farther back than the end of the leg. Spring is adapted to be progressively compressed during the action of the retracting means and is free when the retracting means ceases operation to move the end of the stud against the work. The supporting means extends into the electromagnet, and the spring is nearer to the end of the leg element than is the electromagnet.

» «



Helmet Connection

2,362,610. **Frederick M. Bowers**, Chester, Pa. Filed Aug. 20, 1942. Issued Nov. 14, 1944.

A detachable connection for mounting a welding mask on a "skullguard" protective hat. An extension on the mask is formed with a keyhole slot that coöperates with a headed button on the outer shell of the hat. A pilot stud carried by the shell corresponds in size and shape to an aperture in spaced relation to the keyhole slot and is adapted to be snugly fitted in the aperture and to be completely encircled by it in order to prevent relative sliding movement between the extension and the skullguard.

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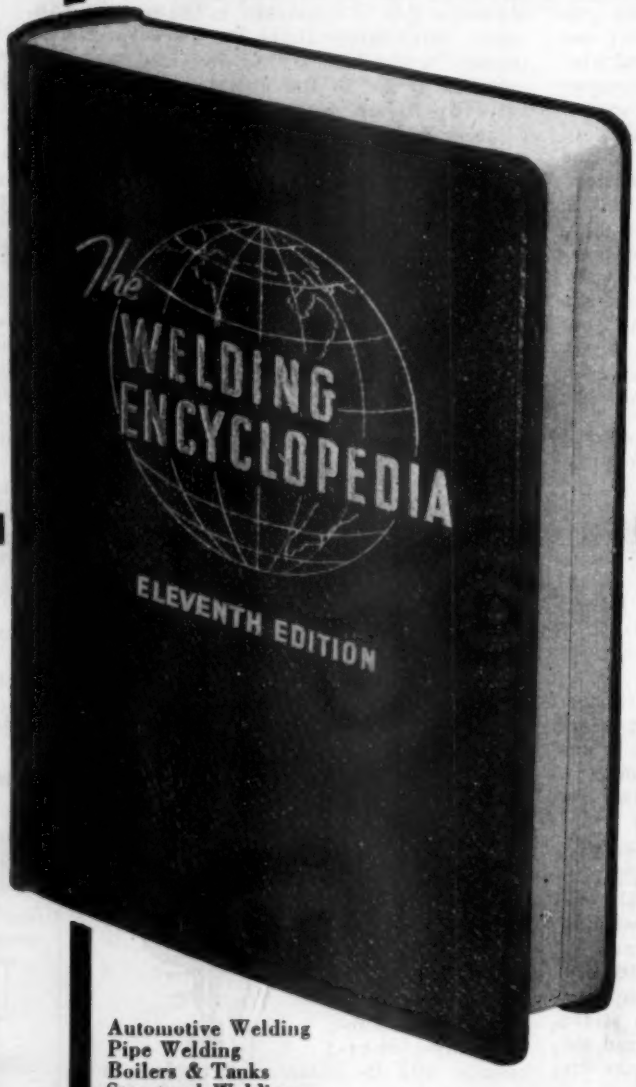

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Don't let the news of recent victories fool you—this war is a long ways from being won. Both on the Rhineland and in the Philippines we're up against the toughest kind of die-hard fanatics who won't quit until they've been literally blasted out of existence. It takes dough to buy the stuff that does the blasting, and that's where you come in.

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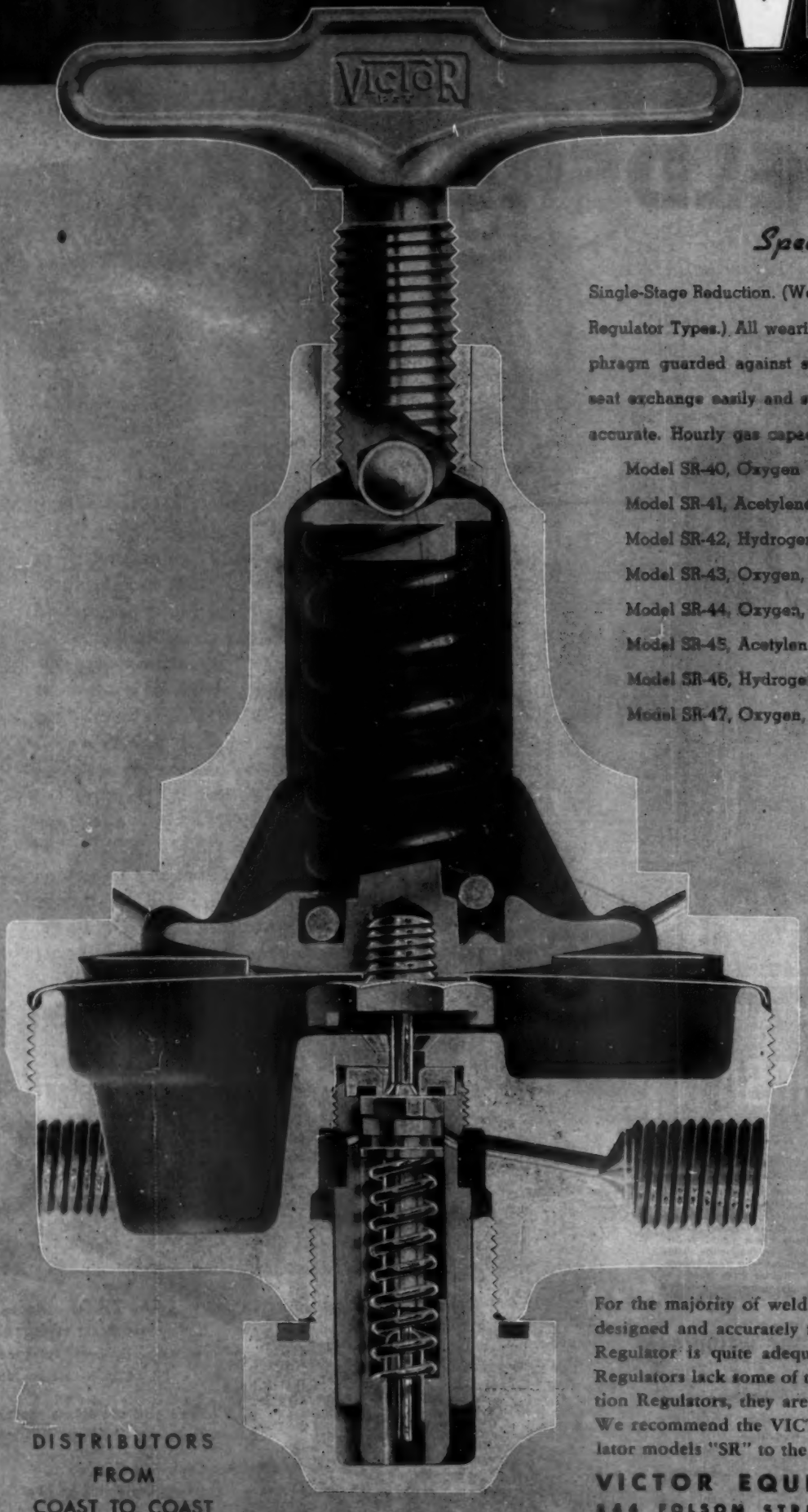

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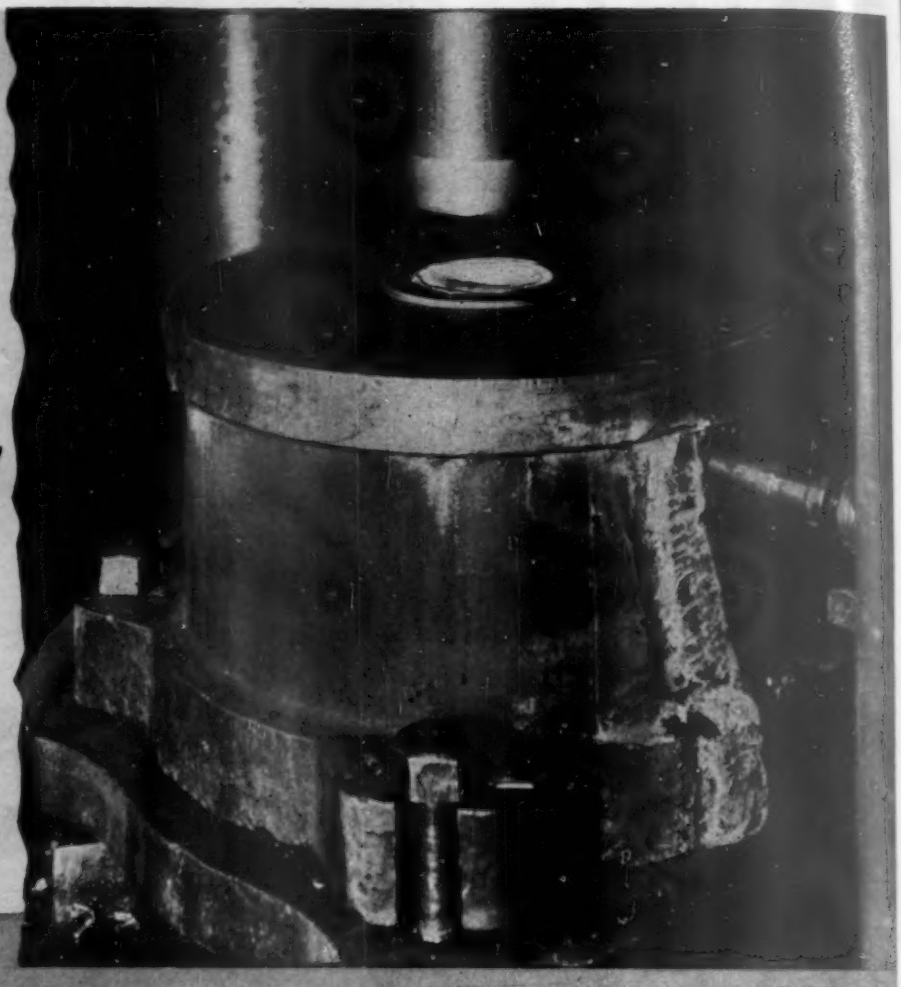

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THIS OLD DIE BLOCK, once broken and discarded, is back on the job, working full time on a hydraulic extrusion press at the National Lead Company plant in Cleveland, Ohio.

Faced with a serious delay in obtaining a new block, this old-timer was brought out of retirement, its cast iron water jacket welded up the side with Anaconda 997 Low-Fuming Rod, and has been giving good-as-new performance in the production of extruded lead and lead alloy rod, wire and seamless tube for more than two months.

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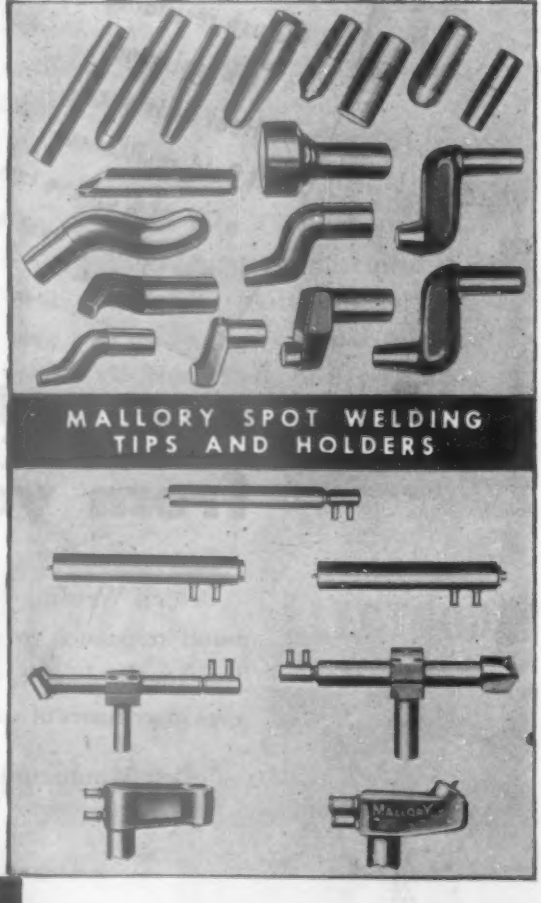

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STRONG, SOUND WELDS

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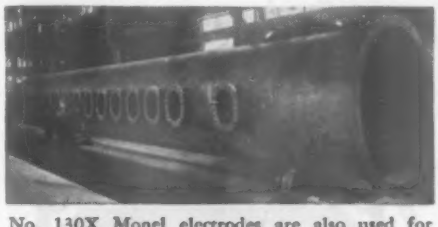
A typical Monel arc weld made with No. 130X Monel electrode.

Monel is extensively used for lining heat exchanger shells. This steel shell is lined with .078" Monel sheet, arc welded with No. 130X Monel electrode. Photo courtesy of The Lummus Company.

Both plug welding and strip welding are employed for lining fractionating and other steel process equipment with Monel sheet or strip. No. 130X Monel electrodes are used. Photo courtesy of Wyatt Metal & Boiler Works.



No. 130X Monel electrodes are also used for welding Monel Clad steel as in this fractionating tower which is six feet in diameter and 43½ feet in length. The top 15½' section is Monel Clad Steel 22/32" thick with ⅛" of Monel cladding. Manways and covers are lined with ⅛" Monel sheet by plug welding. Photo courtesy of Edge Moor Iron Works, Inc.

• • •

The elbows below were readily fabricated from Monel sheet and then arc welded with No. 130X Monel electrodes. Photo courtesy of Farwell, Ozmun, Kirk & Co.

Electric arc welding with Monel offers several important advantages.

Monel is easily fabricated by methods similar to those used in making quality welds in steel. It may be welded in all positions with the same facility.

Monel's coefficient of expansion is the same as that of steel. This permits steel and Monel to be used on the same job.

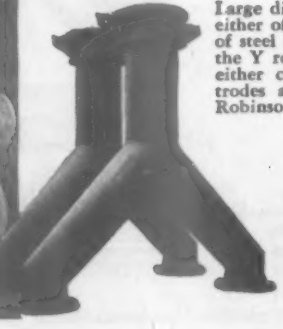
Welds are sound and ductile. In addition, they are as strong and as highly resistant to corrosion as the parent metal. No thermal or chemical after treatment is needed to restore the corrosion-resistant qualities of the welded joints.

As indicated in the photographs, No. 130X Monel Arc Welding Electrodes are employed for welding all forms of wrought and cast Monel to Monel, or Monel to steel.

Engineering data, working instructions, and helpful information on welding procedures are contained in Bulletin T-2, *Welding, Brazing and Soft Soldering of Monel, Nickel and Inconel.* A copy of this well-illustrated, 32-page bulletin will be sent on request.

THE INTERNATIONAL NICKEL COMPANY, INC. • 67 WALL STREET, NEW YORK 5, N.Y.

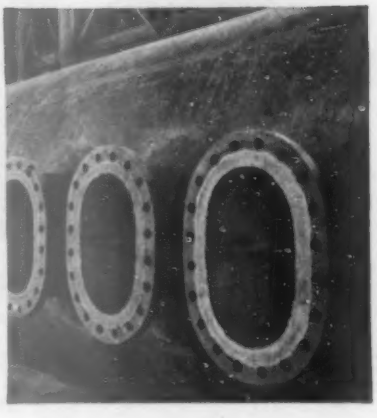
No. 130X *Monel* ELECTRODES



Large diameter piping may be made either of Lukens Monel Clad steel or of steel lined with Monel sheet as in the Y reducers shown at the left. In either case, No. 130X Monel electrodes are used. Photo courtesy of Robinson Engineering Company.

• • •

The steel bolt circles of these manways are overlaid with Monel by a 2-layer weld of No. 130X Monel electrode. Photo courtesy of Edge Moor Iron Works, Inc.



How Much Can *You* Cut the Cost

OF DEPOSITING WELD METAL?

The table at right shows typical cost reductions made possible by carefully selecting the largest size electrode practical for the job at hand. This accurate study takes into account all factors such as labor, overhead, power, electrode costs, etc. Note the progressive lowering of cost as electrode size is increased.

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1/8"	$2.56
5/32"	2.05
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5/16"	.74
3/8"	.55

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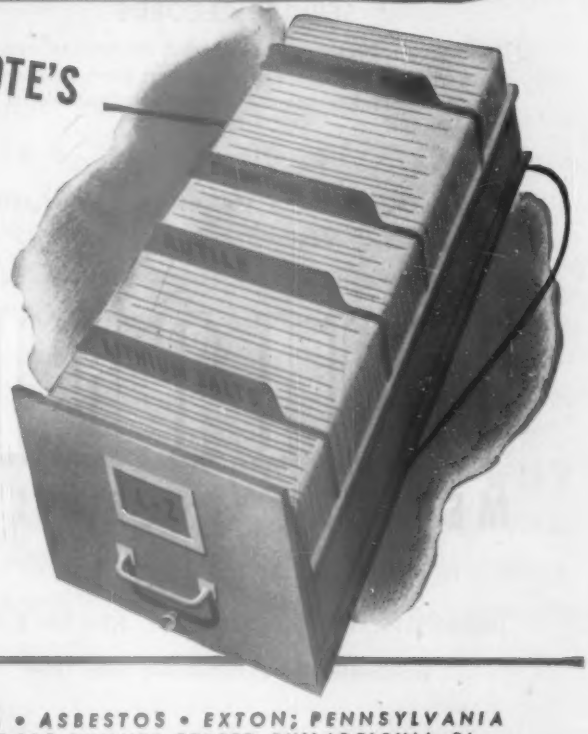

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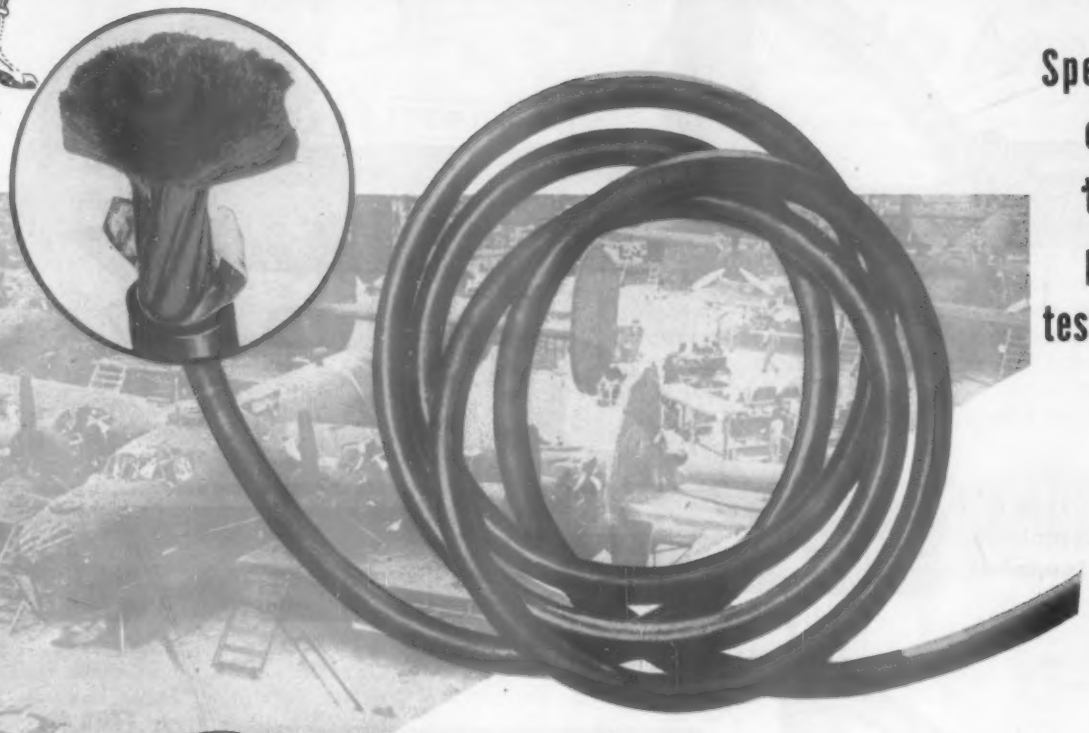

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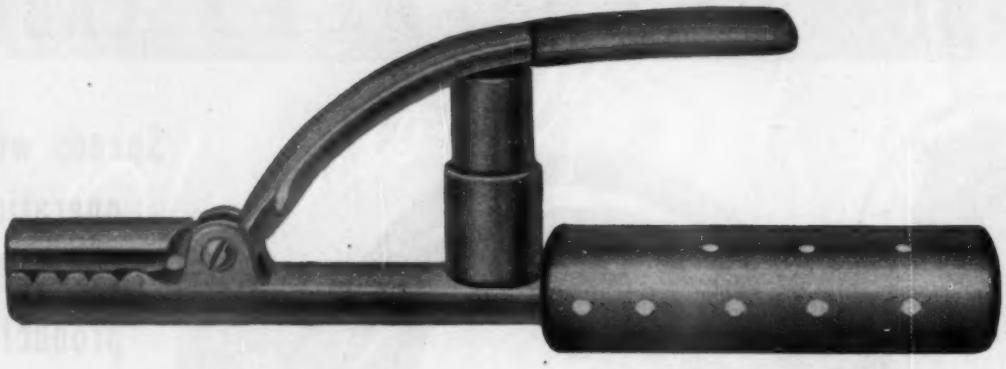

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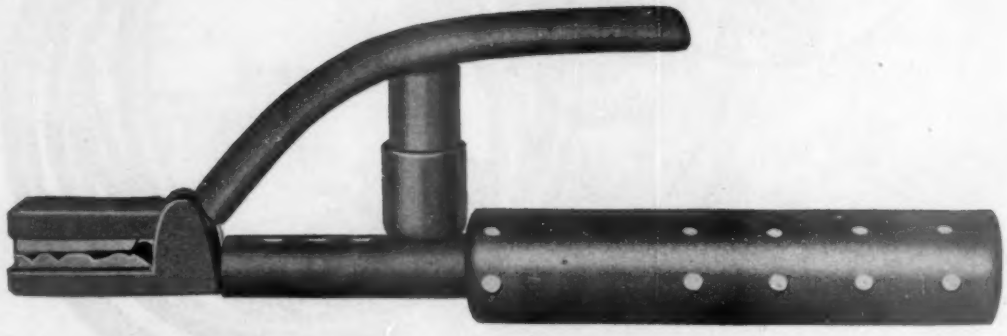
Partially Insulated



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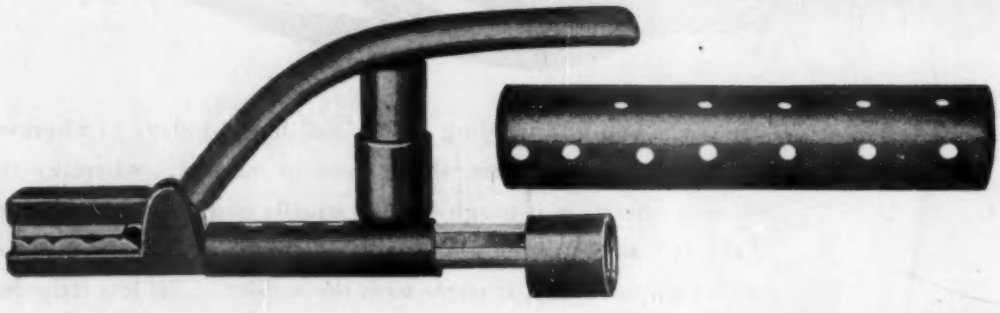

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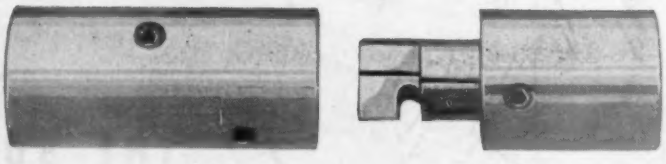

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General Electric Company

YOU can't afford to compromise when choosing electrodes for first-class welding in the vertical or overhead position, because that kind of welding calls for the *best* in both technique and electrodes. That's why operators prefer these two G-E electrodes--they find them mighty helpful in meeting specifications.

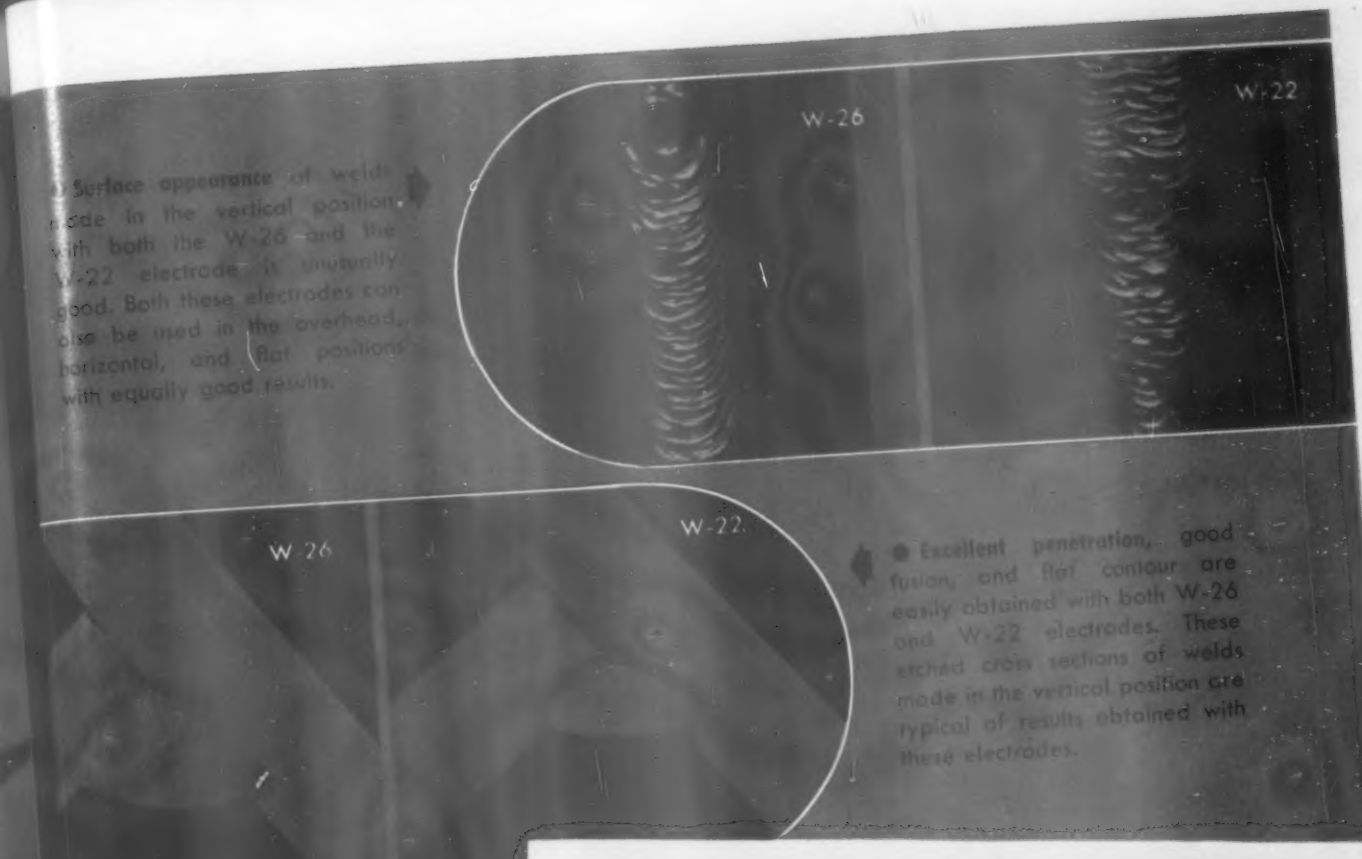
W-26 electrode is recommended for use with *a-c;* easily meets *all* the requirements of A.W.S. Class E6011. It is approved by regulating bodies for both E6011 and E6010. (Therefore it can also be used for d-c.)

W-22 electrode is recommended exclusively for use with *d-c*. It meets *all* the requirements of A.W.S. Class E6010, and is approved accordingly.

Both electrodes produce weld metal which has the *highest* mechanical properties. And both are *easy* to use. They provide a forceful, digging type of arc which gives deep penetration, excellent fusion, and a strong, ductile deposit in all positions. Slag is light and easy to remove. Fillet welds have good appearance and a relatively flat profile.

If you are not one of the thousands already using these production proved electrodes, it will pay you to ask your G-E arc-welding distributor for samples to test in your own shop. He will also be glad to furnish samples and information about other G-E electrodes. Or, write to General Electric, Schenectady 5, N. Y.

GENERAL ELECTRIC



● Surface appearance of welds made in the vertical position with both the W-26 and the W-22 electrode is unusually good. Both these electrodes can also be used in the overhead, horizontal, and flat positions with equally good results.

● Excellent penetration, good fusion, and flat contour are easily obtained with both W-26 and W-22 electrodes. These etched cross sections of welds made in the vertical position are typical of results obtained with these electrodes.

Hundreds of Landing Barges have been fabricated with General Electric a-c welders and W-26 electrodes at the Trageser Copper Works, Maspeth, L. I., N. Y.

ANOTHER User Tells Why He Prefers A-C Welding

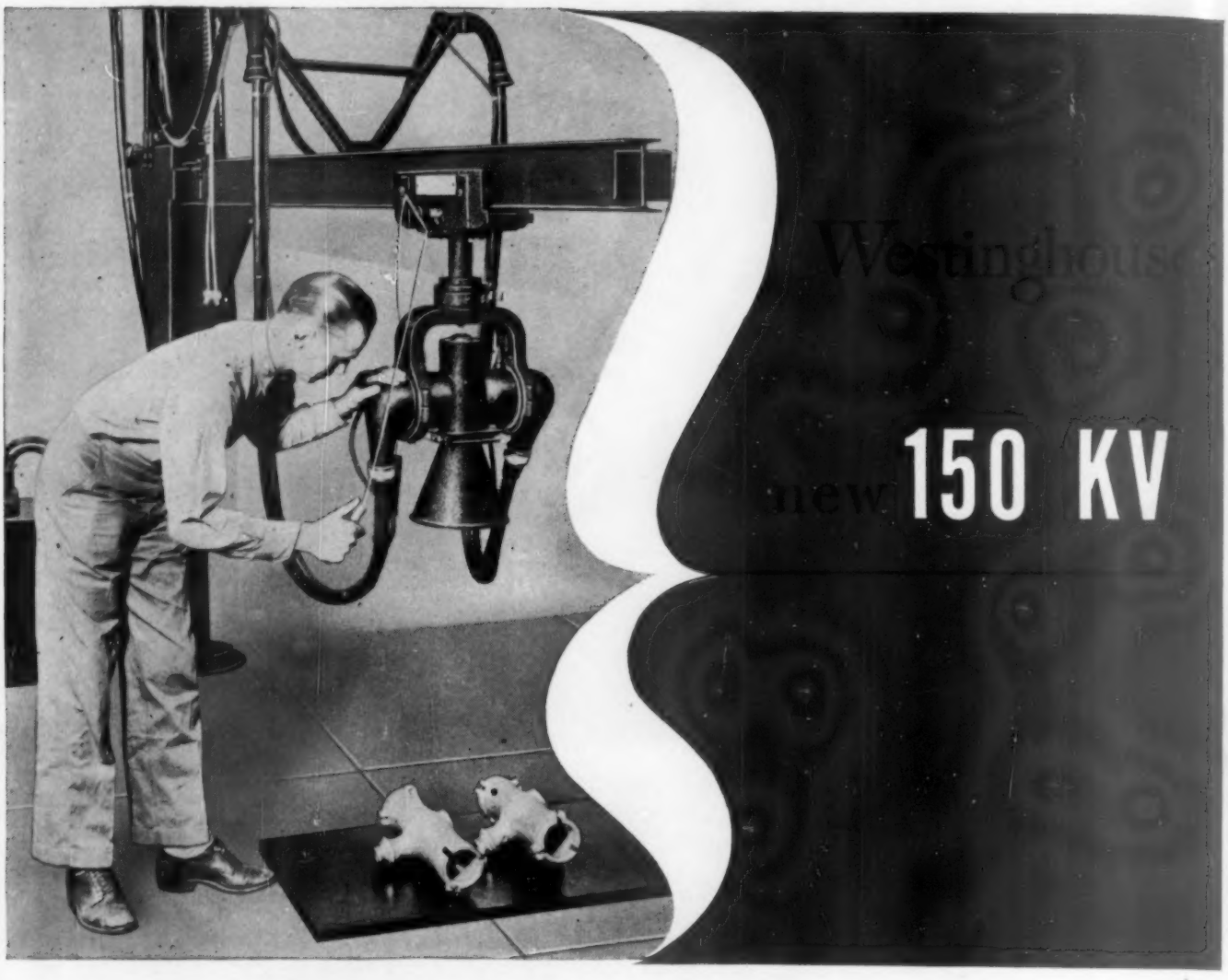
"Our operators prefer a-c welders because, with a-c, they don't have to worry about arc blow — they can weld in every position and in every location and get a good strong joint every time. What's more, our General Electric a-c welders have been operating 20 hours a day, six days a week, for more than two years, and not one has ever required maintenance."

TRAGESER COPPER WORKS

That statement is typical of comments made by virtually every manufacturer who has changed from d-c to General Electric a-c welders. For full details on how a-c welding can help you improve weld quality, increase production, and reduce costs, ask for Bulletin GEA-4081. Simply contact your G-E arc-welding distributor or write to General Electric Company, Schenectady 5, N. Y.

ARC WELDING ELECTRODES and EQUIPMENT

Buy all the BONDS you can — and keep all you buy



The new Westinghouse 150-Kv Industrial X-ray Unit is the result of years of research in industrial x-ray equipment of medium voltage. Within its range, it is the most powerful industrial x-ray equipment available. Using practical exposure times, it is capable of efficiently examining, with screens, 1½" of steel . . . 1" of brass . . . 7½" of aluminum.

With the new Westinghouse 150-Kv, sand castings, die castings, welds, spot welds, wood, plastics, ceramics and all types of electrical and mechanical assemblies can be examined simply and quickly. It is ideal equipment for foundry, welding shop, pipe shop and all industrial applications.

A choice of two tubestands is available for the new Westinghouse 150-Kv Industrial X-ray Unit. The most popular tubestand has a carriage that can be positioned at any height within its 33" to 66" target-to-floor distance. It is suitable for the majority of industrial applications. For x-raying large products, a jib crane tubestand is offered which permits a target-to-floor distance from 18" to 72" in a 10-foot ceiling room.

Call your nearest Westinghouse Office for details. Remember, saying "it's x-ray tested" will be a valuable postwar competitive advantage. Westinghouse Electric & Mfg. Co., Box 868, Pittsburgh, Pa.

Westinghouse INDUSTRIAL X-RAY

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INDUSTRIAL X-RAY

The new Westinghouse 150-Kv Control with X-Actron eliminates guesswork usually associated with milliamperage selection and maintenance. After the milliamperage is chosen, X-Actron, an electronic stabilizer, brings the milliamperage to the desired level and keeps it there for the duration of the exposure.

Constant milliamperage is maintained regardless of fluctuations in line voltage. Operating kilovoltage and other unstable fluctuations do not affect the X-Actron. In fact, the entire operation of the apparatus is so simplified that operational instructions are reduced considerably.

In addition, the new Westinghouse 150-Kv Control is the only x-ray control on which kilovoltage can be accurately read directly. The control also contains an electrically driven x-ray timer with its entire scale divided into hundredths of minutes. This division of scaling simplifies the calculation of exposure timing since most technique charts are developed in milliampere minutes.

This "years ahead" x-ray control is standard equipment with the new Westinghouse 150-Kv Industrial X-ray Unit. Full details are available from your nearest Westinghouse Office. J-08096

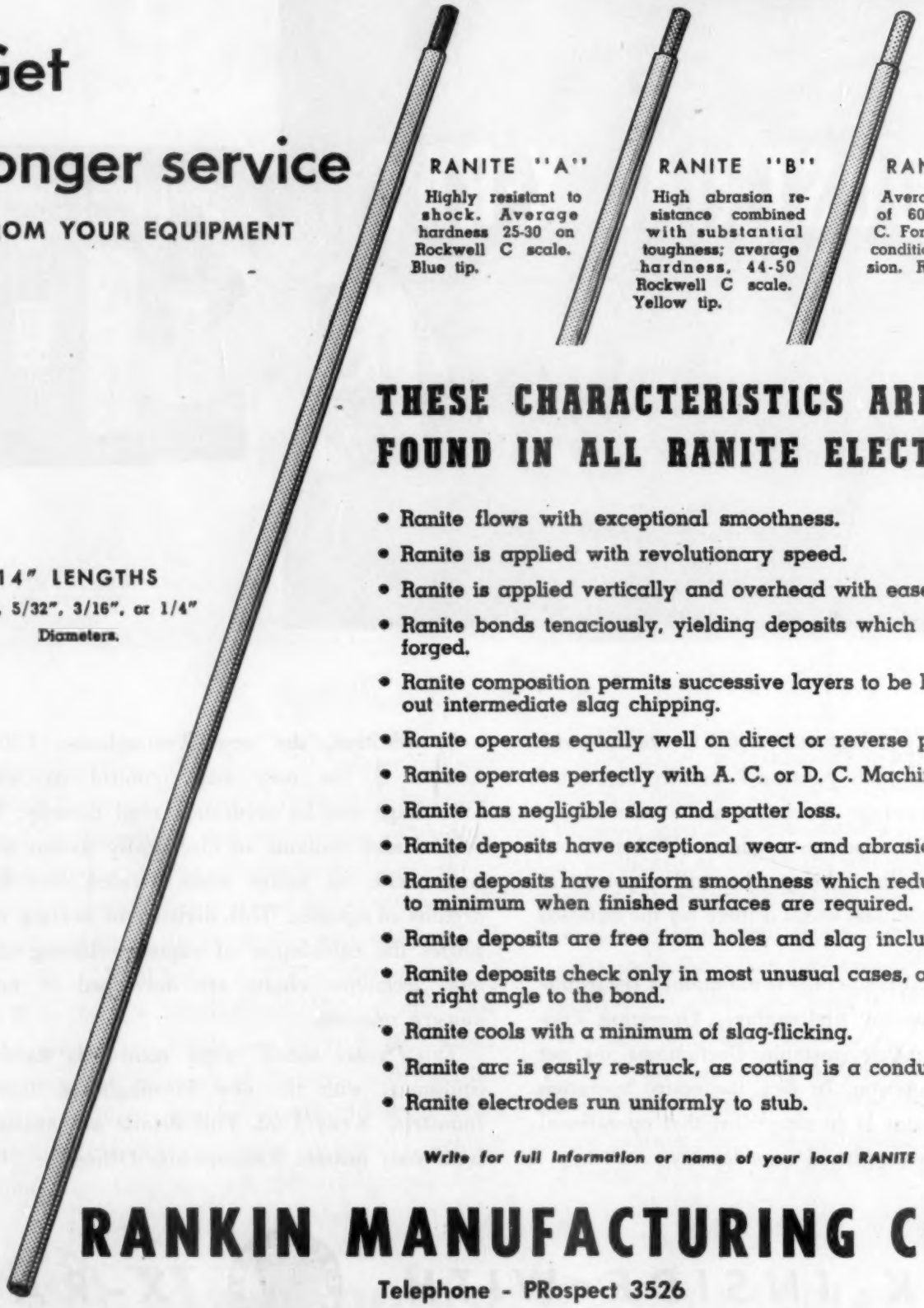
LOOK INSIDE WITH WESTINGHOUSE **X-RAY**

HARD-SURFACE

with Smooth-flowing RANITE

Get longer service

FROM YOUR EQUIPMENT



RANITE "A"
Highly resistant to shock. Average hardness 25-30 on Rockwell C scale. Blue tip.

RANITE "B"
High abrasion resistance combined with substantial toughness; average hardness, 44-50 Rockwell C scale. Yellow tip.

RANITE "C"
Average hardness of 60-62 Rockwell C. For most severe conditions of abrasion. Red tip.

14" LENGTHS
1/8", 5/32", 3/16", or 1/4" Diameters.

THESE CHARACTERISTICS ARE FOUND IN ALL RANITE ELECTRODES

- Ranite flows with exceptional smoothness.
- Ranite is applied with revolutionary speed.
- Ranite is applied vertically and overhead with ease.
- Ranite bonds tenaciously, yielding deposits which may be hot-forged.
- Ranite composition permits successive layers to be built up without intermediate slag chipping.
- Ranite operates equally well on direct or reverse polarity.
- Ranite operates perfectly with A. C. or D. C. Machines.
- Ranite has negligible slag and spatter loss.
- Ranite deposits have exceptional wear- and abrasion-resistance.
- Ranite deposits have uniform smoothness which reduces grinding to minimum when finished surfaces are required.
- Ranite deposits are free from holes and slag inclusions.
- Ranite deposits check only in most unusual cases, and then only at right angle to the bond.
- Ranite cools with a minimum of slag-flicking.
- Ranite arc is easily re-struck, as coating is a conductor in itself.
- Ranite electrodes run uniformly to stub.

Write for full information or name of your local RANITE Distributor.

RANKIN MANUFACTURING CO.

Telephone - PRospect 3526

1403-05 West Washington Blvd. Los Angeles 7, California

FOR PROTECTION against corrosive action of caustics

(or commercial acids)

—fabricate the complete assembly of durable AMPCO METAL and weld with

AMPCO-TRODE

coated aluminum bronze welding electrodes

Use this modern method of fabrication where resistance to corrosion is highly essential

If you have a particular assembly or sub-assembly that must resist corrosion, wear, shock, or fatigue, it pays you well in time and money saved—and in increased salability of your product—to fabricate the assembly of Ampco Metal and weld with Ampco-Trode coated aluminum bronze electrodes.

Ampco-Trode is available in five different grades to meet your specific needs. Because it deposits weld metal comparable in strength, ductility, and hardness with the various grades of cast Ampco metal, it is well suited for the particular job illustrated and for almost any combination of dissimilar metals.

Nation-wide distribution enables you to secure Ampco-Trode quickly. Consult your electrode supplier or write us for information.

W-77

AMPCO

MAIL THE COUPON

AMPCO METAL, INC.
Dept. WE-12, Milwaukee 4, Wisconsin

Please send me Ampco-Trode bulletin, and data on welded assemblies.

Name.....Position.....

Company.....

Address.....

City.....(.....) State.....

it will do for hundreds of other metal products

This clamp is used on a 37 mm. gun. It was formerly machined from a steel casting. Now, they simply roll a piece of sheet steel into a ring, clamp the two steel fittings to it, with cut-to-fit EASY-FLO strips **preplaced** between, and with a few minutes of heating by a torch, the job is done. The result, after cutting at the dotted line, is a clamp fully as strong as the former casting and fully as capable of taking the jarring shocks of gun firing. But here's the big point—**it is produced with substantial savings in metal, labor and cost.**

Equally profitable results have been obtained on a wide variety of other parts and products by changing to EASY-FLO brazed construction—and it is highly probable that some of the parts you are now producing by other means can be made better, faster and more economically with EASY-FLO brazing.

Bulletin 12-A will give you full EASY-FLO details. Write for your copy today.

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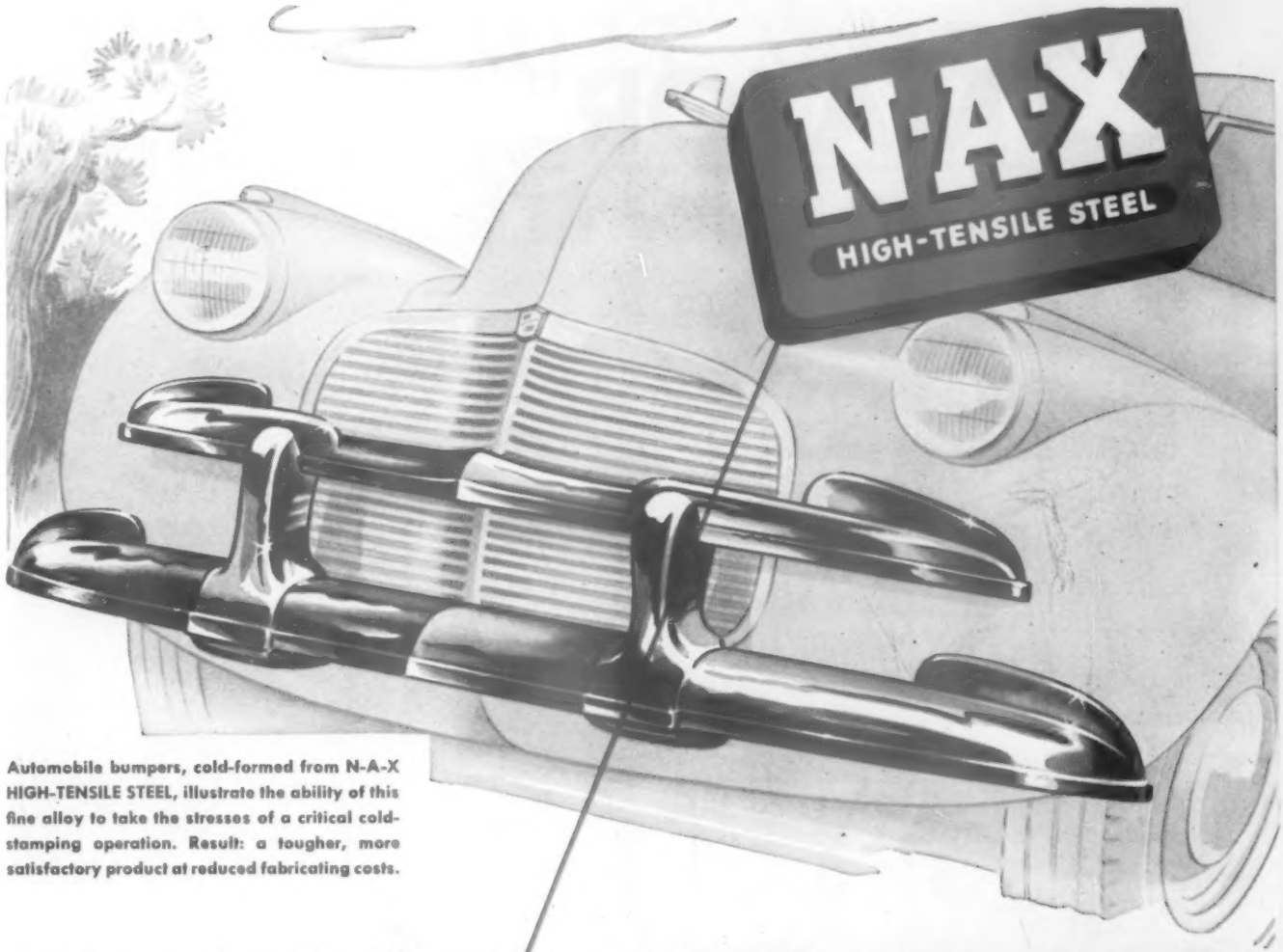


Automobile bumpers, cold-formed from N-A-X HIGH-TENSILE STEEL, illustrate the ability of this fine alloy to take the stresses of a critical cold-stamping operation. Result: a tougher, more satisfactory product at reduced fabricating costs.

THIS HIGH-TENSILE STEEL "TAKES OVER" WHERE DRAWING STRESSES ARE TOUGH

N-A-X HIGH-TENSILE STEEL has stepped into some tough spots in the production of intricate shapes. It has proved to production men that here is a great steel to work with, from the standpoints of both manufacturing operations and finished performance.

To put it in a few words, N-A-X HIGH-TENSILE STEEL has what it takes to make a stronger, tougher product through more efficient production methods. Its exceptional ductility and resistance to impact, inherent in the fine grain structure of a great alloy, often make possible the speed and economy of cold-forming on pieces which must be worked hot when other grades of steels are used. And where critical drawing stresses require hot work, N-A-X HIGH-TENSILE STEEL provides the important advantage of maintaining its high physical properties with minimum cooling distortion even after it has been subjected to a wide range of temperatures. No subsequent treatment is needed to maintain "as rolled" specifications.

Add to these advantages the high fatigue life and resistance to corrosion and abrasion that qualify N-A-X HIGH-TENSILE STEEL for varied types of applications, and you'll see why this fine-grain, low-alloy steel is a factor in postwar planning. Great Lakes Steel metallurgical service is yours on request: Let's have your problem.

GREAT LAKES STEEL
Corporation

DETROIT 18, MICHIGAN • SALES OFFICES IN PRINCIPAL CITIES
Division of NATIONAL STEEL CORPORATION. Executive Offices, Pittsburgh, Pa.

GREAT STEEL FROM GREAT LAKES

HIGHLIGHTS OF N-A-X ALLOY STEEL

N-A-X HIGH-TENSILE STEEL compares favorably with other low-alloy high-tensile steels in yield and tensile strength, with outstanding ductility and notched bar values. In applications where it replaces mild-carbon steels, it serves to reduce weight or increase strength through the utilization of these properties in design.

Another property that may interest you is the excellent weldability of N-A-X HIGH-TENSILE STEEL—whether welded to itself or to other high-tensile or structural steels of welding quality.

N-A-X 9100 SERIES STEELS are produced in carburizing and constructional grades. Except for carbon, they have a chemical analysis that is constant within definite ranges. Together with X-9100 Series steels, containing molybdenum, they provide hardenability ratings to cover a wide variety of requirements, yet give an all-purpose analysis to yield properties. Molybdenum confers great depth hardenability to extend the usefulness of the N-A-X 9100 Series, which are medium-hardening steels.

N-A-X ARMORPLATE is an example of the exacting requirements that Great Lakes can meet with this low-alloy series. One of the X-9100 Series steels is the basis of the armor we produce for tanks, armored cars and practically all landing craft.

"MAJOR" WELDING CABLE—

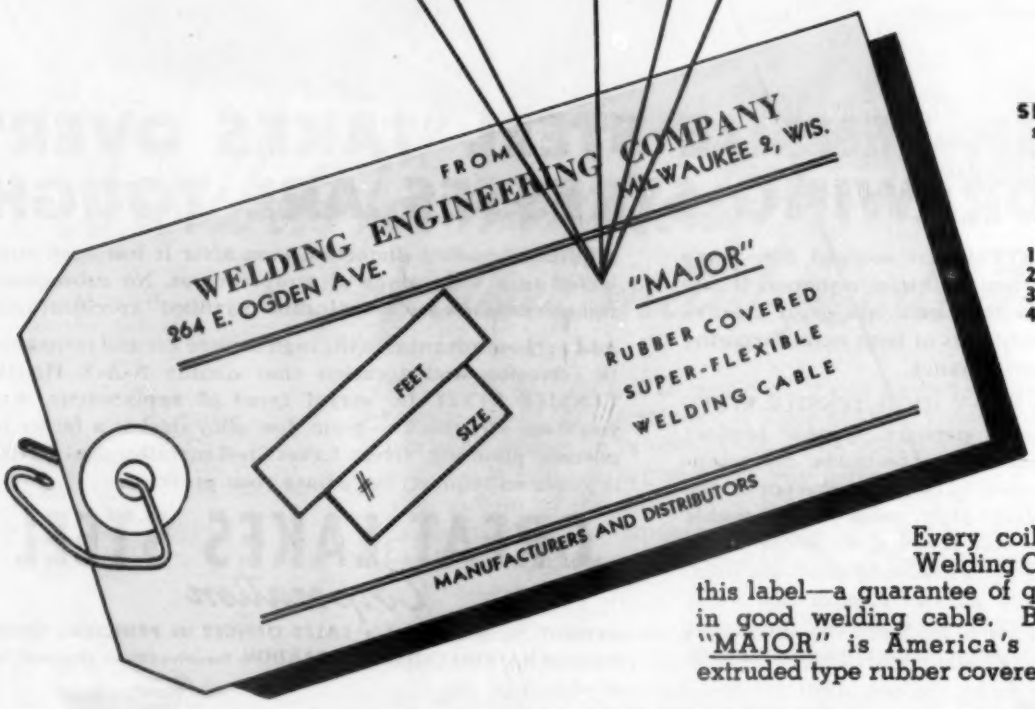
Super Flexible

Waterproof

Oil Resistant

Rubber Covered

Durable



SIZES AVAILABLE:

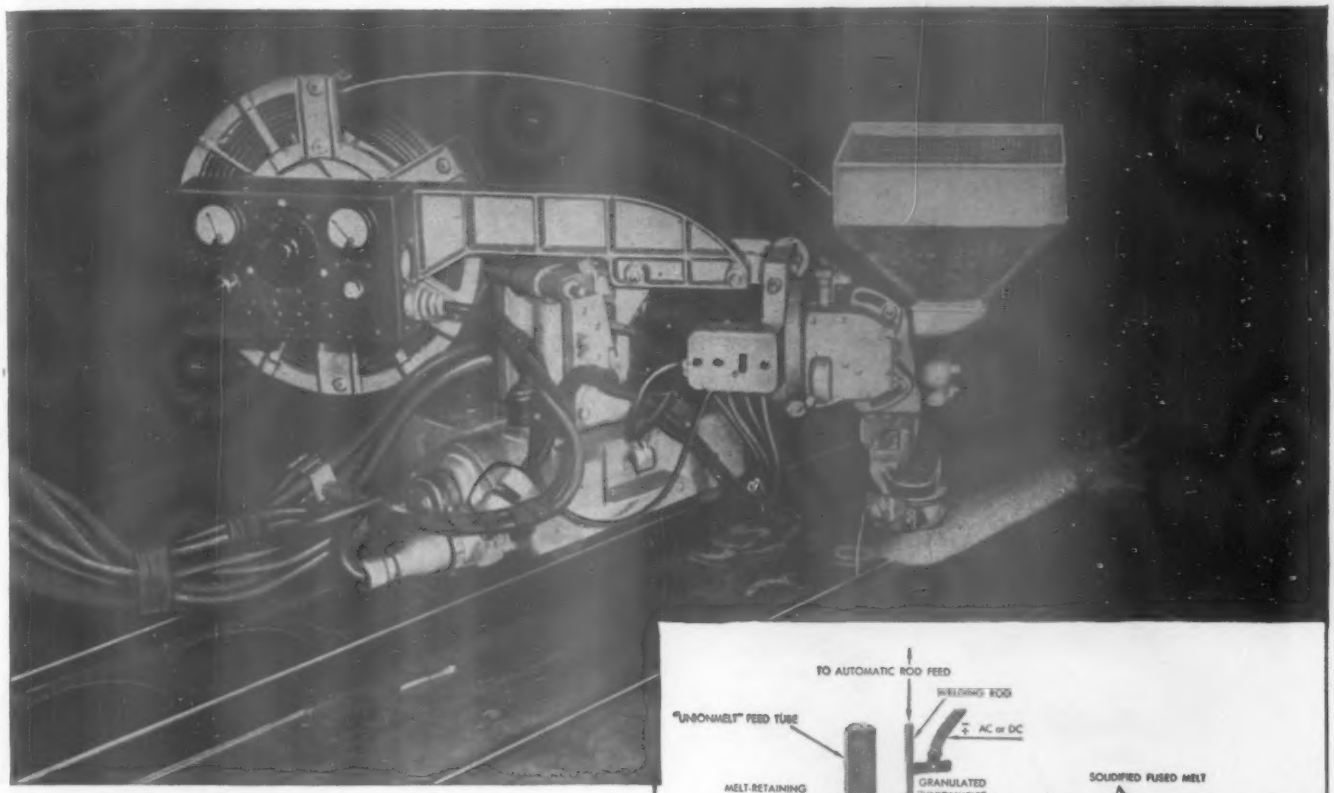
Size	Strands	Amps.
6	950	75
4	1029	125
3	1323	150
2	1666	200
1	2156	250
1/0	2646	300
2/0	3381	375
3/0	4284	450
4/0	5376	550

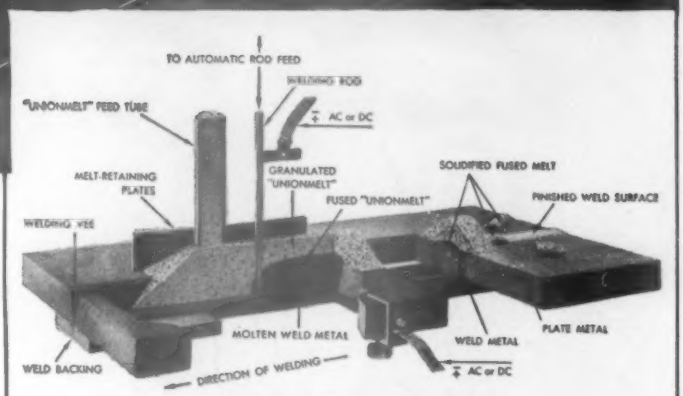
Every coil of "MAJOR" Welding Cable sold carries this label—a guarantee of qualities essential in good welding cable. By national poll, "MAJOR" is America's "First Choice" extruded type rubber covered welding cable.

AMERICA'S FASTEST SELLING WELDING CABLE

WELDING ENGINEERING COMPANY
MILWAUKEE, WISCONSIN
MANUFACTURERS—DISTRIBUTORS
OFFICES AND AGENTS ALL OVER THE UNITED STATES

UNIONMELT WELDING





Linde's Automatic Electric Process

UNIONMELT electric welding joins steel of any commercially used thickness at speeds up to twenty times faster than similarly applicable methods. Because the process is automatic, it produces uniform welds of unusually high-quality with minimum dependence on the manual skill of welding operators.

The flexibility of UNIONMELT welding has led to its application for a wide variety of work—for heavy and light material, for repetitive operations or single jobs, and for shape-welding as well as for straight-line and circumferential welding.

Metal-fabricating shops of all kinds can profit by using the UNIONMELT process for either fabrication or repair work. If you are interested in learning more about this process, or in discussing its possibilities for any particular application, please write to us.

BUY UNITED STATES WAR BONDS

HOW IT WORKS

1. A special granulated material known as UNIONMELT is laid down along the seam to be welded so that it covers the end of the welding rod.

2. Heat, generated by passing an electric current through the UNIONMELT composition between the welding rod and the parts being welded, progressively melts some of the UNIONMELT so that it forms a protective blanket over the weld area.

3. Underneath this molten UNIONMELT composition, metal from the rod and from the plate edges are fused to form the weld.

4. The molten UNIONMELT cools and solidifies behind the welding zone and, on further cooling, contracts and detaches itself.

The process of welding electrically beneath a mineral melt by the method illustrated is patented.

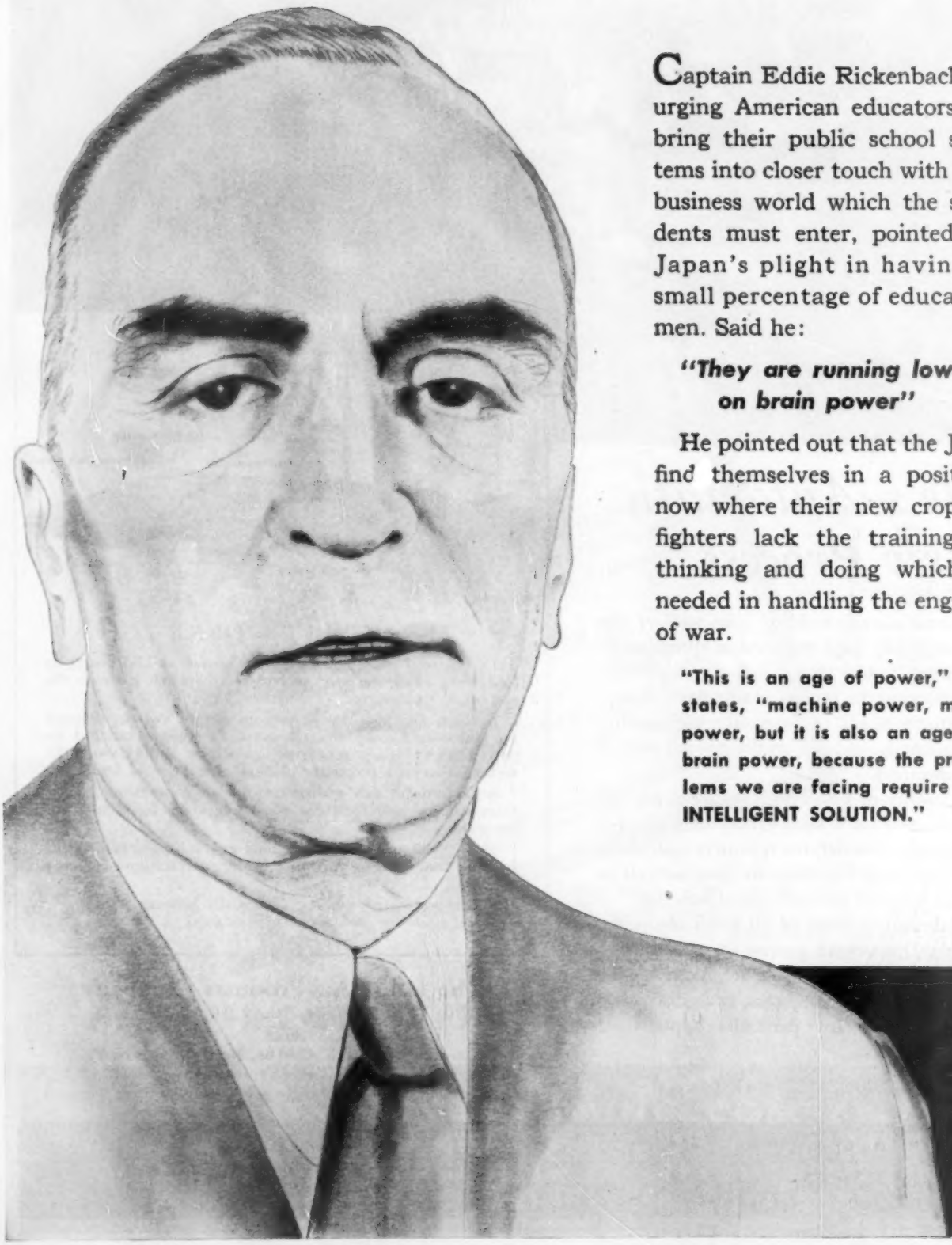
The Linde Air Products Company
Unit of Union Carbide and Carbon Corporation
UCC
General Office, 30 E. 42nd St., New York 17, N. Y.
Offices in Other Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto

LINDE OXYGEN . . . PREST-O-LITE ACETYLENE . . . UNION CARBIDE
OXWELD, PUROX, PREST-O-WELD, UNIONMELT APPARATUS
OXWELD AND UNIONMELT SUPPLIES

The word "Unionmelt" is a registered trade-mark of The Linde Air Products Company

then he said to himself

"They're Short on Brains"



Captain Eddie Rickenbacker, urging American educators to bring their public school systems into closer touch with the business world which the students must enter, pointed to Japan's plight in having a small percentage of educated men. Said he:

"They are running low on brain power"

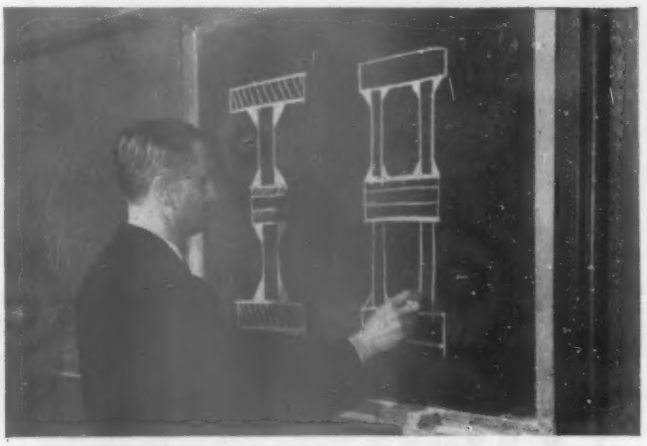
He pointed out that the Japs find themselves in a position now where their new crop of fighters lack the training in thinking and doing which is needed in handling the engines of war.

"This is an age of power," he states, "machine power, man power, but it is also an age of brain power, because the problems we are facing require an INTELLIGENT SOLUTION."

"INTELLIGENT SOLUTION," *he says*

LOOK, CAPTAIN, how these examples of Lincoln Service help intelligently to solve problems in all phases of arc welding application:

BASIC TRAINING. More than 20,000 welders have sparked their careers in Arc Welding by getting the sound foundation afforded by the Lincoln Welding School. 120 hours of continuous practice in latest techniques under leadership of world-famous instructors. In addition special courses are offered in the welding of alloys, pipe and sheet metal. Full details in Bul. 416.



ENGINEERING SCHOOLING. An advanced course in welding engineering for shop supervisors, engineers, designers and executives. Held regularly in Cleveland at Lincoln plant. A valuable "eye opener" for ways to improve products and cut costs. 5 days' instruction by nationally prominent authorities. Write for details and schedule of dates.

PRACTICAL POINTERS. The Lincoln "Stabilizer" magazine, packed full of "how to weld it" facts, reported by welding operators themselves, helps more than 100,000 "Men-Behind-The-Mask" find intelligent solutions to all kinds of production and maintenance problems. Sent free to welding operators who request it.

LIBRARY OF KNOWLEDGE. The world's leading books on all phases of Arc Welding. A total of 4911 pages of authentic facts and studies gathered by experts in all industries the world over. Total price of all 7 books only $7.50 C.O.D.

THE LINCOLN ELECTRIC COMPANY • Cleveland 1, Ohio

Another LINCOLN *Contribution to..*

America's greatest natural recourse

ARC WELDING

GOOD *cast iron brazing begins with* a GOOD *tinning job*

Use the New AIRCO HI-BOND FLUX

(FORMULA NO. 35)

● Because of their graphitic nature, the surfaces of many types of cast iron do not tin satisfactorily when a conventional type of flux is used. Airco's HI-BOND Flux has been especially developed to overcome this condition. It is not intended for use in the actual brazing operation but rather for application before brazing to overcome tinning troubles. This flux is particularly effective on cast irons having a high carbon and silicon content or low combined carbon.

Airco HI-BOND Flux is packaged in powder form in 1-lb. glass containers. It is easy to apply—merely mix it with water to form a paste and brush on the cast iron surface to be brazed—or sprinkle the powder itself on the surface which has already been heated to the required temperature. Continue the brazing operation with a conventional brazing flux such as Airco MARVEL or HI-TEST and observe how well the molten bronze adheres to the surface.

Air Reduction specializes in the development of fluxes for welding and brazing; a partial description of some of these will be found at the right. Further details on these and other Airco fluxes will be furnished by any Airco office. Call or write today.

A FEW OF AIRCO'S QUALITY FLUXES

Airco Marvel Flux: Unexcelled for brazing cast iron, malleable iron and steel, and for welding brass and bronze, 1-lb. and 5-lb. containers.

Airco Hi-Test Brazing Flux: A new improved liquid-paste flux which increases density, hardness, quality of deposit and other physical properties. Minimizes undesirable fumes. Packed in 2-lb. jars.

Airco Napolitan Sheet Aluminum Flux: Most satisfactory and economical for welding sheet and cast aluminum. Packed in ¼-lb. and 1-lb. containers.

For facts on these and other Airco Fluxes, write for a copy of Catalog 22-C.

★ BUY UNITED STATES WAR BONDS ★

AIR REDUCTION

General Offices: 60 EAST 42nd STREET, NEW YORK 17, N. Y.

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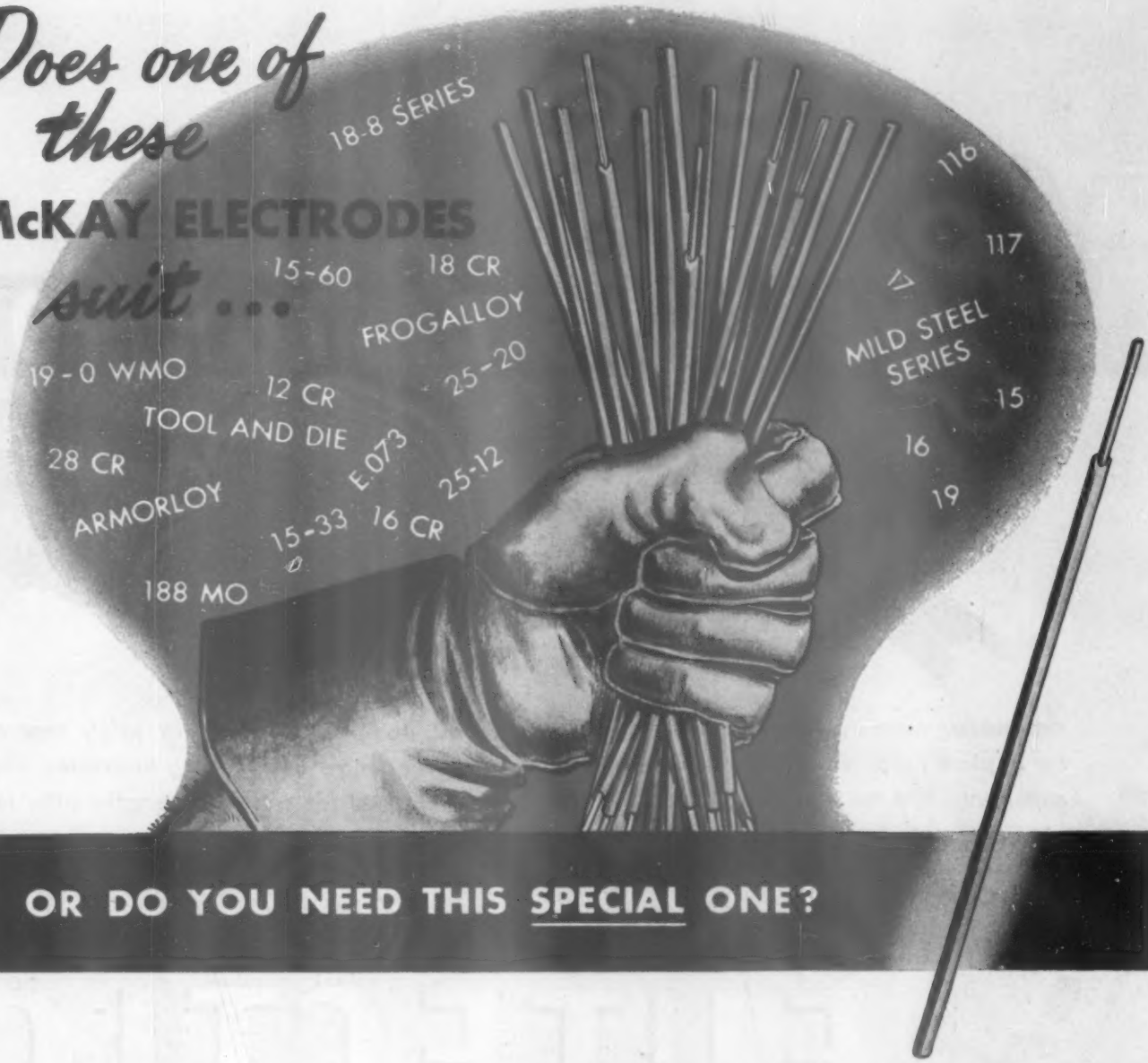
Offices in all Principal Cities

Does one of these McKAY ELECTRODES *suit . . .*



OR DO YOU NEED THIS SPECIAL ONE?

McKAY GIVES YOU THE RESEARCHED LINE

The McKay slogan, *"every* electrode a leader," is based on the determination to make every grade as good as painstaking research, careful manufacturing and unusually thorough step-by-step testing can make it. In addition to our own laboratories, an active fellowship in Mellon Institute fully qualifies McKay Electrodes to be called the *Researched Line.*

You will find in the *standard* line of McKAY Electrodes an exceptionally wide range of mild steel, alloy steel and stainless steel rods of analyses suited to almost every welding need. From a range of 40-odd mild, alloy and stainless grades, you can normally select an electrode which will exactly fit your requirements.

Occasionally, however, the need for a special electrode for a specific purpose will arise. In such cases, the facilities of our plant laboratory, working in collaboration with our Mellon Institute research department, will be placed at your service to develop the proper type of electrode for your particular job.

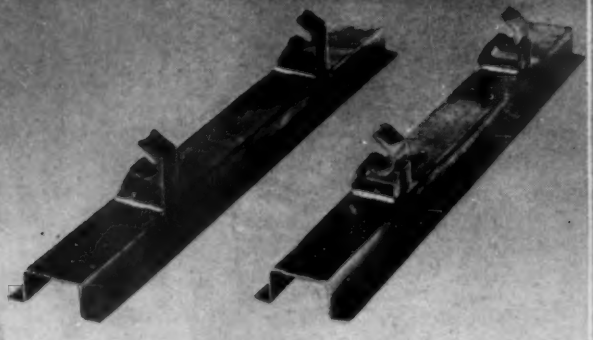
If available standard selections are not adequate, don't hesitate to ask for *this special* McKay service. Send full technical facts for our recommendations.

GENERAL SALES OFFICES: YORK, PA.

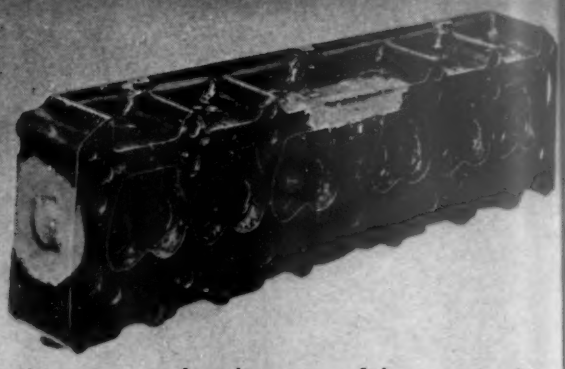
THE McKAY COMPANY
PITTSBURGH, PA.

WELDING ELECTRODES . . . COMMERCIAL CHAINS . . . TIRE CHAINS

AVOID WELDING DISTORTION



Arc welding bombsight hanger on frame member of plane produced severe warping and misalignment. Eutectic Low Temperature Welding prevented distortion and formed strong joints.



Cast iron motor heads are safely repaired without danger of subjecting to stresses, eliminating need for costly and lengthy after machining always necessary to correct distortions.

WITH EUTECTIC *Low Temperature* WELDING RODS

EUTECTIC (Pronounced U-tec-tic) Reg. U.S. Pat. Off.

Every day—there are jobs that can be done *better* the EUTECTIC way. *Try it today!*

Castolin Eutectic

hard surfacing electrodes

RACO 25 Shielded Arc Electrodes produce excellent results in building up worn parts and surfaces on which a tough deposit of moderate hardness is needed, such as shafts, gear teeth, hawser pipe and crane wheels. RACO 25 Electrodes meet the requirements of U. S. Navy Specification 46E3 (INT) Grade EE. Hardness range: 20-25 Rockwell C. Machinable.

RACO 45 Shielded Arc Electrodes—for surfaces which require no machining, but which must resist severe wear and abrasion, such as shaker screens, wheel flanges and tractor treads. RACO 45 Electrodes meet the requirements of U. S. Navy Specification 46E3 (INT) Grade ED. Hardness range. Rockwell 40-50 C.

RACO 55 Shielded Arc Electrodes—for building up surfaces requiring still greater hardness than that provided by RACO 45 Electrodes, such as dipper teeth, crusher pads, brick-making machinery and cement mill equipment. Hardness range: 50-60 Rockwell C.

Welding qualities of these three grades of RACO Electrodes are essentially the same. Either direct current (straight polarity) or alternating current may be used. Vertical welding may be done with each grade in 3/16" diameter and smaller. Deposits are dense, and requisite hardness is obtained in single layer as well as in multiple layers. No heat treatment is required.

Send for free samples of these RACO Electrodes. Test their top-performance qualities to your own satisfaction. Just write

The REID-AVERY COMPANY

DUNDALK BALTIMORE 22 MARYLAND

SINCE 1919 PRODUCERS OF ARC WELDING ELECTRODES AND WELDING RODS

All over the Home Front

ON REPAIR AND MAINTENANCE WORK

P&H HARMOMANG

A Proved Electrode For *high* Resistance to Impact, Abrasion and Wear

Harmomang is an electrode with the work-hardening qualities which suit it especially for the building up or hard surfacing of manganese and carbon steels.

It is a coated moly-manganese electrode with a hardness range up to 43-46 Rockwell "C". It can be used on AC, or for either straight or reverse polarity on DC.

Harmomang is the ideal electrode to use wherever you need protection against both impact and abrasion. For example: for hard surfacing dipper lips, dipper teeth, bucket runners, rock crushers, railway frogs or wherever longer life is desired for parts made of manganese or carbon steels.

Write direct for full information and procedures or see your P&H representative.

A COMPLETE ARC WELDING SERVICE

P&H Alloy ELECTRODES

General Offices:
4513 W. National Ave., Milwaukee 14, Wis.

HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS — P&H — ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

Canadian Distribution: The Canadian Fairbanks-Morse Co., Ltd.

Classified Section

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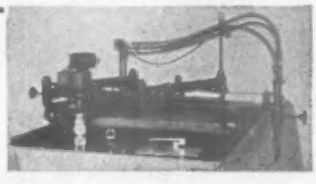

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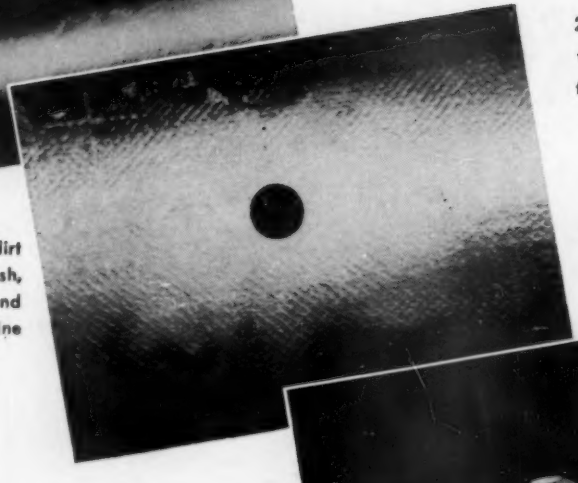
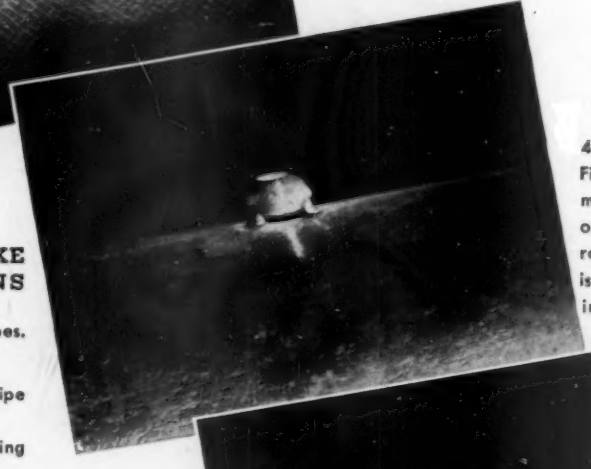
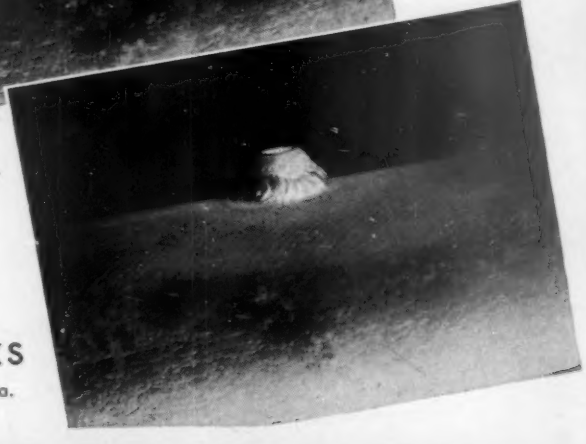


2. Using fitting as a template, mark opening with scribe and center punch. Cut hole with torch for best results.

3. Tack-weld fitting in place. Two to four tacks are sufficient depending upon size of fitting. Allow sufficient clearance between fitting and pipe for penetration of weld-metal.



4. Weld in place. Fill bevel with weld-metal, as shown, to obtain satisfactory results. Inside of joint is easily cleaned and inspected.



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